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AN INTRODUCTION TO THE

CONTINUOUS IMPROVEMENT PROCESS

PRINCIPLES & PRACTICES

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The Continuous Improvement Process (CIP) is a means by which an organization creates and sustains a culture of continuous improvement. The organization deliberately seeks to create a positive and dynamic working environment, foster teamwork, apply quantitative methods and analytical techniques, and tap the creativity and ingenuity of all its people. Collective effort is focused to better understand and meet internal and external customer needs and to continuously increase customer satisfaction. Employing CIP in an organization can substantially improve the quality of its services or products, increase productivity, and reduce costs across a broad spectrum of systems, products, and services.

A few of the major companies that now use and proclaim their commitment to CIP-related management technologies are Phillips, Ford, Xerox, IBM, Hewlett-Packard, Toyota, Honda, Boeing, Chrysler, and Texas Instruments. In the public sector, DoD has instituted a continuous improvement initiative called Total Quality Management. These and other organizations that are committed to a continuous improvement philosophy report substantial improvements in quality, productivity, throughput, and employee morale, with significant reductions in cost, errors, leadtimes, waste, and customer complaints. The consensus among CIP-oriented companies is that these technologies are the key to their long-term competitiveness and survival.

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Central to CIP are mechanisms that define, assess, and improve all the significant processes within the organization and identify, reduce, and eliminate where possible all forms of waste. CIP addresses all forms of work and applies equally to management and administration and to knowledge worker and touch labor processes. CIP includes a number of principles, practices, techniques, and tools that have proven effective in fostering change for continuous improvement. The elements have been applied with considerable success and in a variety of combinations by many different organizations in the United States and overseas.

The potential benefits of employing CIP are extremely large. CIP has produced substantial results in the first year of implementation for most of the pioneering organizations. However, the experience of the pioneering companies clearly shows that CIP requires a long-term commitment, deliberate and thorough planning, coordination, cooperation, and a top-down systematic process of deployment in order to get it right the first time.

An extensive program of education and training for all organizations seeking a culture of continuous improvement will be essential. However, the courses, "how-to" textbooks, and facilitators needed to meet the immediate need are still in short supply. This introduction to the principles and practices of CIP is intended to help fill the need for educational materials and to provide a common frame of reference for the ongoing dialogue about continuous improvement in the private and public sectors. Ultimately, each organization must weave the elements of CIP together into a seamless improvement process that best meets its specific needs.

PREFACE

During the four decades between the end of World War II and today, Japan rose from a defeated and destroyed nation to become a leading economic power with a worldwide reputation for high-quality, high-value products. It achieved dominance in the world marketplace for numerous highly technical products while Europe and America watched their market shares for those same products erode. The Japanese transformation has been called by some an economic miracle.

In 1980 NBC aired "If Japan Can – Why Can't We?" a television white paper that examined the rise of that nation as a major industrial and economic power. That media event triggered a process of change in American business thinking and practice that continues to gain momentum. The knowledge and experience gained from this process has shown American managers that "If Japan Can – So Can We!" While many factors contributed to the Japanese "economic miracle," including some rooted in their culture, the most important factors come down to fundamental and good management practices that apply to businesses large or small, in both the private and public sectors.

During the 1980s many American organizations have investigated the Japanese success story and have adopted and expanded, often through trial and error, many powerful ideas, tools, and techniques. The collective experience and the lessons learned by those organizations comprise a body of knowledge that is crucial to our economic future.

The management practices that have become essential for survival in the rapidly changing world marketplace have been described under a variety of names. One of those names, the Continuous Improvement Process, is the umbrella term we use to describe the process of managing for continuous improvement and success.

Executive Summary

INTRODUCTION TO THE CONTINUOUS IMPROVEMENT PROCESS: PRINCIPLES AND PRACTICES

The Continuous Improvement Process (CIP) is a means by which an organization creates and sustains a culture of continuous improvement. The organization deliberately seeks to create a positive and dynamic working environment, foster teamwork, apply quantitative methods and analytical techniques, and tap the creativity and ingenuity of all its people. Collective effort is focused to better understand and meet internal and external customer needs and to continuously increase customer satisfaction. Employing CIP in an organization can substantially improve the quality of its services or products, increase productivity, and reduce costs across a broad spectrum of systems, products, and services.

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CHAPTER 1

INTRODUCTION

"Since World War II we have entered into a period which will be to the future what the Renaissance was to the past. We have moved into a new age that is fundamentally different from the age from which we have come."[1] We are entering one of the most challenging periods in our history. The challenges that face us will test our nation, our organizations, and each of us as managers and leaders.

Technological developments have been the precursors of each of the major world transformations we characterize as an Age. In the past the people alive at the dawning of an Age were largely unaware of the events that would ultimately alter the lives of their offspring. The processes of cultural transformation in all previous Ages was relatively slow and their impact on societies gradual and diffuse. We are witnessing the birth of a Systems Age that will replace the Machine Age spawned of the Industrial Revolution. The very technologies that are the precursors of the Systems Age make it possible for us to become rapidly aware of events and make it inevitable that our lives, not just those of our descendants, will be forever changed.

The end of an Age does not occur with the throw of a switch. Rather one Age fades into the next and is characterized by people struggling with the problems of the new Age using the tools, techniques, and paradigms of the past Age. These struggles are marked by the cultural dislocations that occur as societies attempt to adapt to the new world reality. Eventually those societies that successfully develop and adapt new and more appropriate tools, techniques, and cultural paradigms emerge as leaders. Often the rise and fall of nations is a function of their ability to adapt to the world's technological transformations.

PURPOSE

This document discusses some of the best available management technologies for improving quality, increasing productivity, and reducing costs. It is intended to

[1] Ackoff, Russell Lincoln. *Redesigning the Future: A Systems Approach to Societal Programs.* New York: John Wiley & Sons. 1974.

assist organizations in getting started on a journey toward continuous improvement. It should help managers and supervisors at all levels to recognize and accept their roles and responsibilities in leading an improvement effort. The concepts presented here apply equally to civilian and military leaders and to every aspect of business in the private sector, Government, and the defense establishment.

The book briefly explores why continuous improvement is important to each and every one of us. It provides a brief overview of the Continuous Improvement Process (CIP), examines the core philosophy underlying CIP, presents its key principles, explores the practices that bring those principles to life, and offers a general model for continuous improvement. These can help you start your own journey toward continuous improvement.

Finally, this book provides a common definition and frame of reference for the ongoing dialogue about continuous improvement within the private sector, Government, the Department of Defense, and the defense industrial community.

BACKGROUND

We are living in a time of unprecedented technological change and growing global competition. On the commercial side we see Japan capturing the advantages of high quality and low price in area after area. Some find refuge in attributing the Japanese success to unfair trade practices, unfavorable exchange rates, or national cultural differences. While those factors may play some small role, they certainly are not the root causes of the competitive difference.

The attribution of national cultural differences is particularly spurious. Before World War II, the same Japanese culture had a reputation for producing junk; "Made in Japan" was a joke. A careful examination of the difference between Japanese and American industries reveals that the average Japanese business is less efficient and less productive than the average American business. The Japanese advantage exists in those industries that have adapted and expanded upon management ideas and technologies that in fact were originally developed in the United States.

The significant cultural difference between the best industries and the others is not in *national* culture but rather in *business* culture. The leaders have created corporate cultures that successfully tap the intellectual capacities of all their employees. They have created an environment in which better management

technologies are sought and encouraged to take root. They are characterized by high levels of employee involvement, awareness of customer needs, understanding their business processes, employing problem-solving and process-improvement techniques, organizing for teamwork, and management commitment to a process of continuous improvement.

Its phenomenal economic rise since the end of World War II can in part be attributed to how Japan viewed and managed change. The U.S. industrial infrastructure emerged from World War II largely unscathed while the engines of most other industrial powers lay in ruins. Thus, the United States enjoyed a postwar period of advantage during which our technology and products were recognized as superior to those of the competition.

During that period, we followed management practices viable only in a world of little real competition. We became overconfident in our leadership role, complacent about the quality of our products and services, and short sighted in our business planning and decision making. Many managers believed that products and processes should be changed only when absolutely necessary. "Don't fix it if it isn't broken," became their credo. Change was viewed as a threat to be resisted or a cost to be avoided. As a result, many managers adopted practices that discouraged change.

The Japanese, on the other hand, with the help of American visionaries like W. Edwards Deming, Dr. J. M. Juran, and Dr. A. V. Feigenbaum came to see quality as the key to becoming competitive in the world marketplace and to view change as opportunity. They learned that to stand still in a world of constant change was to fall behind. Since they believed that it was absolutely necessary to continuously change products and processes, they adopted management practices that fostered and encouraged change in order to produce continuous improvement.

Let us explore this need for change at its roots. The Industrial Revolution ushered in the Machine Age, which transformed the nature of work and the lives of people around the world. The Machine Age fundamentally and permanently altered manual labor processes and produced an immense increase in the production of goods and services. An equally important revolution has been unfolding in our lifetime that is again transforming the nature of work and lives. This new revolution is driven by information technology that is fundamentally and permanently altering

mental work processes. The changes brought by this new revolution are propelling us into the Systems Age. The dislocations that are already becoming apparent are or will be as profound as those that marked the transition from the Agricultural to the Machine Age. The nations, organizations, and individuals that can recognize the importance of these changes and that can adapt to meet them will be the leaders in this new Age. Those who are too slow to learn and adapt will face great difficulty.

It is apparent to most of us that an ever-increasing rate of technological change is an inescapable world reality. More technological change has occurred in our lifetime than in all of preceding history. The same will be true for the lives of our children and grandchildren. The systems of management that were adequate in the early 1900s will not meet the tougher tests that we and our children face. The shortcomings of the current management systems are already evident in dislocations manifest as lack of competitiveness, declining manufacturing capability, and lost leadership in key technologies.

Many organizations and managers are still employing the tools, techniques, and paradigms of the Machine Age as they begin to deal with the problems and complexities of the new Systems Age. The management methods that still predominate are based on the theories of Taylor, Galbraith, Skinner, and other pioneers of Machine Age scientific management. These approaches were reductionist in nature and patterned on the very machines that shaped the Age. They were characterized by breaking things down into their fundamental elements and by making optimum each element. These approaches were appropriate for their time but they did not result in optimum systems. Dr. Russell Ackoff illustrates this point with the following example: Suppose you were to acquire all the makes of automobile produced in the world and systematically select from the set the best carburetor, transmission, brakes, and so forth. However, when you attempt to assemble the world's best possible automobile from the collection of best parts, you would not even be able to produce an automobile because the parts would not fit. The performance of the whole is not the sum of the performance of the parts, it is a consequence of the relationship between the performance of the parts.

Machine Age management technology does not enable us to synthesize and understand information in sufficient breadth to comprehend the relationships of performance among the parts to permit the system to be effectively optimum. As illustrated in Figure 1-1, performance dramatically improved during the Machine

Age but was constrained by the limitations inherent in making optimum the performance of each of the parts. The tools and techniques associated with information technology has made it possible to more effectively deal with the larger and more complex management of whole systems. The philosophy of management most appropriate for the new Age has only begun to evolve. However, we are better able to focus on its elements as organizations around the world experiment with alternative management approaches. Many of the new management principles are based on the theories of Deming, Juran, Kaoru Ishikawa, and other pioneers of Systems Age management methods. Performance has again begun to climb dramatically in those organizations that are employing these Systems Age management technologies. Such pioneering organizations have demonstrated that significant continued performance growth is not only possible but that it is essential for survival in today's rapidly changing environment. We must recognize and apply the set of principles and practices that characterize the most successful organizations. CIP is a term intended to encompass and integrate the variety of principles, practices, techniques, and tools being employed by the organizations that are leading the way in performance and quality improvement.

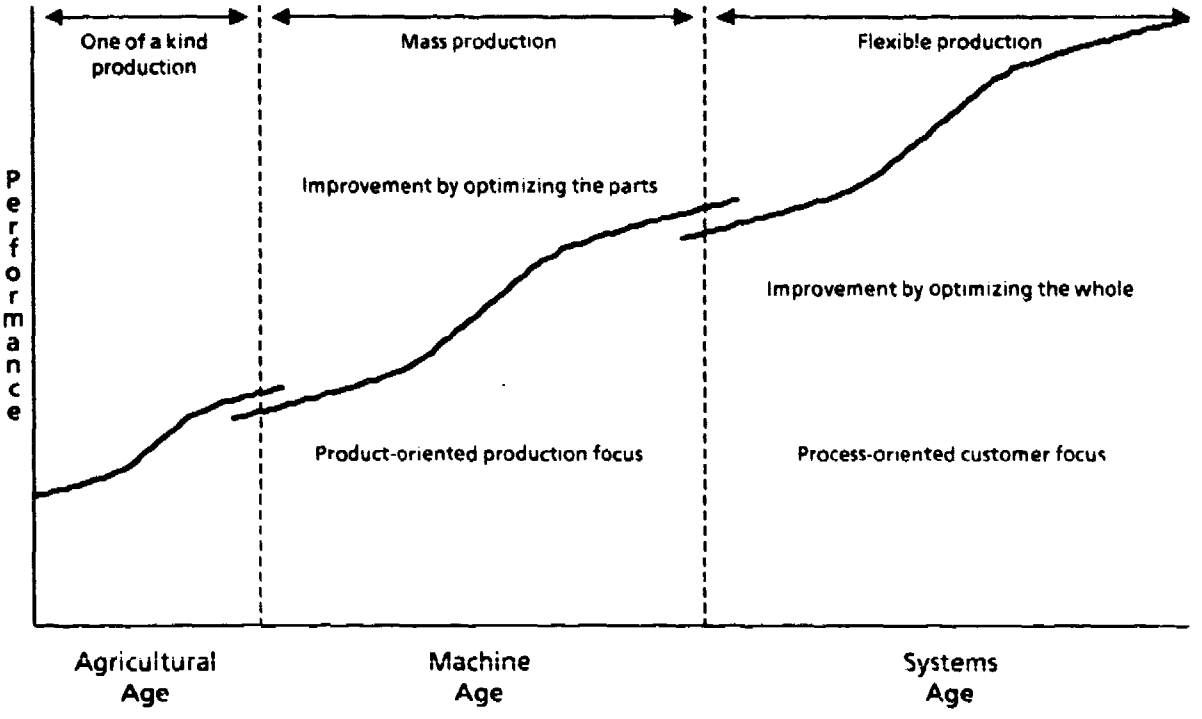

FIG. 1-1. PROFILE OF PERFORMANCE IMPROVEMENT

The "secret" of the Japanese economic miracle is, in part, a successful change in management strategy and process. We, too, must recognize the inevitability of change and the opportunity to manage and direct change for improvement. The elements of CIP, when properly employed, make it possible to achieve continuous improvement. They provide a road map for gaining control over the processes we manage and focusing our resources for successful change management.

Continuous Improvement Process is a broad concept that encompasses the best available management technology for the Systems Age. It is neither a fixed set of things or actions, nor is it a cookbook for managers. Rather, it is a dynamic process by which organizations can continuously change to be current with the best management practices and through which they can best manage that change. Management technology, like all other technologies, must continuously adapt to accommodate changing world realities. Likewise, managers must continuously grow to stay aware of and to employ the best available management technology.

More scientific, industrial, and technical change has occurred in this century than in all of previous recorded human history. Since change is inevitable and is happening at an ever-increasing pace, we must face the significant challenge of successfully managing it if we are to survive. Governments as well as businesses must accept the challenge.

CHALLENGE

The challenge the United States faces is immense. Many of its management practices evolved in the Machine Age, and lost their edge in the post-World War II recovery period. For example, the majority of quality management still emphasizes inspection instead of prevention. Management education and training have neither effectively encouraged nor enabled managers to learn and apply new and better management technologies. Few degree-level management training courses integrate powerful new management philosophies, techniques, and tools into course content. The Government regulatory and organizational environment has often discouraged the free flow of communication and the generation and acceptance of new ideas. For example, many organizations are stovepipe structures that stress vertical reporting but lack meaningful lateral dialogue across functions or with other closely related organizations.

A challenge for the United States lies in how to successfully integrate and coordinate the improvement process across a diverse array of disciplines and systems. No single formula can achieve continuous improvement in all situations or organizations. However, a core set of ingredients is evident in most successful continuous improvement efforts. Tapping the power of individuals, multiplying that power through teamwork, and focusing that power on understanding and improving processes are the keys to success.

Industry and Government must permit their constituent organizations and contractors to develop tailored CIP efforts that best fit their unique requirements. They must also provide the leadership, set the example by applying CIP to their own operations, and frame goals and objectives for improvement that will focus the efforts of their components. The elements of CIP described in this document are building blocks; the challenge for each organization is to craft a successful improvement process from these and other appropriate concepts.

Many organizations are already rising to the challenge. Recognition that change is needed is growing and the willingness to begin the change process is increasing. This movement is becoming a ground swell that bodes well for our future. The Government's main challenge is to encourage that groundswell, assist industry, and remove the obstacles to the gathering momentum of CIP in all our industries and endeavors.

Of equal importance it must be understood that all organizations are made up of individuals. The performance of the organization is affected by the performance and interaction of its individual members and the success of the whole depends on the collective contributions of the individuals. Ultimately, we each have a stake and a responsibility in helping our organizations learn, adapt, and improve. Likewise, the organization has a stake and responsibility to better serve its individual members and, in doing so, serve its purpose more effectively. Understanding this challenge and how we respond to it will shape our individual and collective future.

Organizational transformation starts with individual initiative and leadership. That leadership is essential, especially at the top of the organization, but also at every level and in every area. If we are to succeed, every member of the organization must become involved in the effort. At the core of this book is the message that we must not wait for the organization to guide us toward change;

rather, we as individuals and as teams must lead and help to transform our organization through learning and adapting. The challenge therefore is a personal one as well as a national one. You must decide how and when to begin your journey toward continuous improvement. Your future, that of your organization, and ultimately that of the nation will be influenced by your decision.

DEFINITION

The Continuous Improvement Process is a means through which an organization creates and sustains a culture of continuous improvement. CIP engages the total organization in improvement activity and requires management leadership to create a cultural environment that stimulates change for improvement. The process involves every member of the organization, applies to every activity, and focuses on creating and managing change to assure success and survival.

The improvement process is directed by top management, which leads the effort by deliberately shaping the organizational environment to stimulate creativity, pride, teamwork, and knowledge enrichment. The process aims at achieving a shared vision and fulfilling the mission of the organization. Management seeks to craft a totally integrated effort working toward improving performance at every level and in every activity. The process entails the use of quantitative methods; disciplined application of techniques and tools; creation of individual and team ownership of processes; and accelerated development of knowledge, skills, and human potential. These process components are focused on the achievement of top-level goals through tangible improvements in measured performance criteria such as quality, cost, schedule, manpower development, new product development, and ultimately customer satisfaction.

OVERVIEW

Many diverse elements interact, often in very subtle ways, to shape a comprehensive system of management. When a management process is subjected to the deliberate change process, managers must be acutely aware of these subtle interactions so that it can discover and remove unanticipated roadblocks to achieve desired improvements. Such roadblocks may appear, at first blush, to be unrelated to the process targeted for improvement. CIP poses a real and personal challenge for

each individual manager to be open to new ideas and new ways of seeing and to question the traditional management paradigms.

Experience has shown that one of the most essential ingredients of successful change management is recognition by the top executives that change is necessary and that it requires their personal commitment and leadership. Success starts at the top. Top management must be the first to discover what must be done and how to do it, and then must do it. Improvement efforts, begun at the top, flow with less resistance down into an organization because top management understands what it takes; appreciates the degree of difficulty; and provides the necessary commitment, example, education, and support.

The management process for stimulating, supporting, and achieving continuous improvement must be unending. The organization that embarks on the continuous improvement journey must understand that the destination is never reached. Management's objective is to direct and produce deliberate continuous change in all its processes and through such change to secure its competitive advantage. Since some segment of the competition can be expected to constantly improve its products and services, the CIP organization must improve faster and more intelligently to catch up or to stay ahead. The CIP transformation affects five primary aspects of an organization: (1) environment, (2) structure, (3) individual and team activity, (4) communication, and (5) integration.

With the introduction of CIP, the environment in the organization evolves to one that nurtures the improvement process. Environmental changes include increasing the emphasis and availability of education and training; tailoring the reward and recognition system to reinforce improvement-oriented behaviors; increasing the emphasis on, and wider participation in, the planning process; clarifying the recognition of customers and increasing the emphasis on customer satisfaction; increasing reliance on rigorous analytical methods and statistical evidence; clarifying and demonstrating attention to identifying and removing the sources of fear and insecurity and the roadblocks to improvement; and increasing respect for the capabilities and contributions of individuals.

The structure of CIP organization changes to permit the most effective employment of the practices, techniques, and tools used in the improvement-oriented culture. These structural changes include forming teams to define and implement

the improvements and to define and take active ownership of work processes. Changes may also include relocating functions to reduce process times or to better address customer needs. For manufacturing operations, structural changes often include reorganization of floor space and layout to accommodate improved production techniques, including group technology; cellular processing; and ultimately automation, robotics, or flexible manufacturing technology.

Individual and team activity in the CIP organization generates improvement. The changes in individual activity include creating and implementing ideas and suggestions for improvement and differentiating between the necessary and the unnecessary, including making an effort to straighten up, put things in order, clean up, and maintain equipment. Individuals are given greater responsibility for managing, maintaining, and controlling their immediate work environment. Changed team activity includes regular team meetings; definition, analysis, and improvement of team-owned processes; creation and management of team process performance measurement systems; interaction with team customers; and development of team process improvement strategies.

Arenas and forms of communication change to become more open, personal, and relevant. Special effort is made to improve the frequency, timing, and quality of communication in both the vertical dimension (to upper and lower management levels) and in the horizontal dimension (to other equivalent levels) of the organization. The changes affecting communication include policy deployment, a communication mechanism to focus and guide team activity toward achieving top-level goals; quality function deployment (QFD), a communication mechanism to better integrate product or service development efforts; and improvement project reporting to spread and share improvement experience and results. Systems for reporting performance data are changed by moving the responsibility for information analysis and response to lower levels and communicating to higher levels any data relevant to higher level goals and objectives. Financial accounting methods are changed to better communicate the true costs associated with producing a product or service and to recognize the value of investing in improvement technology.

The fifth aspect of an organization that is affected by CIP is the integration of functions and disciplines. One dramatic change that effects integration is the reduction of organizational and functional barriers in terms of both social divisions

and physical locations. Managers, engineers, technicians, and administrators who should regularly communicate are frequently commingled in a common work space. Reduction in the number and diversity of job codes, job grades, and work specialties is encouraged, and greater emphasis is placed on generalization and flexibility. Many traditional functions are integrated back into the general work force; for example, quality assurance becomes part of every person's job, systems engineering becomes a routine consideration for every process-improvement team, and process teams assume responsibility for performance measurement. Just-in-time concepts permit inventories to be reduced to levels at which inventory management is integrated with production processes.

Each of these five aspects of organizational change is shaped by a variety of principles, practices, techniques, and tools, which are the elements of CIP. Since the improvement process must continue to embrace the broad array of technologies that contribute to real improvement opportunity, the inventory of CIP elements is dynamic and flexible. Many of the elements now collected under the CIP umbrella are presented in this primer. They have been identified from the practices and experience of companies that successfully seek change for improvement. The pioneering experience of each company is unique. However, their aggregate lessons learned provide a clear road map for both the transition to, and the maintenance of, a culture of continuous improvement.

Each pioneering company started from a unique position and employed different tools and techniques, often in a trial-and-error fashion, to create change for improvement. Interestingly, each approach, no matter how limited, quickly produced results that were considered successful. Most of the approaches, however, soon ran out of steam or were found to be incomplete. To maintain the momentum of improvement, each company had to integrate new or additional techniques and tools into its efforts. The collective picture of their individual patchwork approaches shows that they are all converging on a common set of technologies. It is this set that is clearly the most effective and that comprises CIP as described in this document.

Among the many individual elements that comprise CIP are a *philosophy* (see Figure 1-2), which contains the purpose, vision, and theory underlying CIP activity; management *principles*, which contain the fundamental concepts, rules, and assumptions guiding CIP decisions and actions; *practices* that are the repeated demonstrations of CIP behaviors through action; and *techniques*, which are the

technical methods for accomplishing specific CIP aims, and *tools*, which are items or devices used in performing a CIP activity.

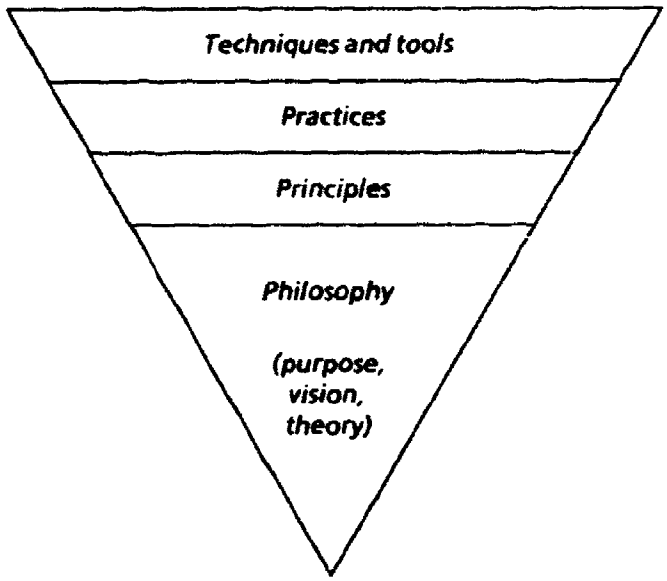

FIG. 1-2. INTERRELATIONSHIP OF CIP ELEMENTS

These four elements interrelate in a hierarchical manner. The philosophy provides a focal point and purpose for the pursuit of CIP. The principles serve as a framework that shapes and guides CIP decisions and actions. Practices in turn are the repeated actions that put the principles into effect. The tools and techniques support or are required in the execution of the CIP practices.

In the following chapters we examine the philosophy and many of the common principles and practices that comprise CIP.

CHAPTER 2

PHILOSOPHY

A key premise underlying CIP is "to survive and thrive, an organization must continuously and successfully adapt to its changing environment." In *The Origin of Species*, Charles Darwin described a process of natural selection among living organisms over which an individual organism has little or no control. A parallel selection process exists in the world of organizations, but an organization can exercise a significant degree of control over its destiny. The crucial difference between natural selection and the organizational model is the role that knowledge plays in influencing the outcomes.

The advanced nations of the world are leaving the Industrial Age and are entering the Information Age. This new Age is characterized by new realities, including an exponentially increasing rate of technological change, more sophisticated and demanding customers, and an increasingly competitive world marketplace for all goods and services, including defense systems. Economic constraints in this new Information Age will no longer permit organizations with inefficient or inflexible systems to compete successfully and survive. Information Age organizations will need to anticipate changing customer requirements, respond quickly to technological advances, and adopt flexible strategies and processes. They must also adopt a philosophy that will unify their employees in the process of continuous improvement.

An organization's philosophy is its shared system of values, motivating principles, and concepts. Traditionally, U.S. managers have given little consideration to the importance of philosophy or to its role in shaping organizational culture. The CIP organization, on the other hand, deliberately examines its shared values, principles, and concepts to ensure that they promote continuous improvement and customer satisfaction and ultimately result in competitive survival. The CIP organization seeks to adopt a philosophy that unites and energizes its employees. The following five components are key to that philosophy: a *theory* that defines the need for collective action; a common *purpose* that unifies the employees and defines their mission; a *vision* that focuses their actions on a desired

transformation; a set of *values* that establishes limits of acceptable behavior; and *policies* that codify and communicate the key concepts of the organization's philosophy.

THEORY

Underpinning the philosophy of the CIP organization is some theory that crystallizes the need for improvement. For many organizations survival is the issue. A theory to which such organizations might subscribe is "Organizations that understand the needs of their customers and that continuously improve their processes, products, and services accordingly will survive, and the others will cease to be relevant." In the long view, such a theory applies equally to commercial business, defense industry, and Government organizations.

A theory that defines an organization's need to improve is equally important in competitive and noncompetitive environments. For example, even though the Internal Revenue Service is noncompetitive, it has embarked on a process-improvement effort. It has a mandate to collect all tax revenues owed to the Treasury (a customer), to correctly and fairly serve the taxpayer (another customer), and to treat employees (internal customers) fairly and to help them reach their greatest potential and it has a publicly recognized need to improve on all fronts. The Internal Revenue Service therefore requires a theory that will crystallize for its employees why they should pursue improvement. Such a theory might state, "Understanding the needs of all our customers and improving our processes accordingly will increase taxpayer compliance, enhance Federal revenues, raise employee morale, and improve the IRS's reputation and working environment." The theory provides the rationale for commitment to the effort.

The CIP organization takes time to develop a management consensus for its theory and makes certain that the theory is widely disseminated to the work force. The subsequent improvement effort is in essence an open test of the theory. Organizations that attempt continuous improvement without articulating a theory lose an important motivating factor and ultimately lack the basis for assessing their overall result. However, even these organizations must have an implicit theory, albeit unrecognized, if they are to construct their improvement effort intelligently.

Theories for competitive organizations are generally more obvious and straightforward than those for noncompetitive ones. Theories based on competitive advantage are already being tested in the world commercial marketplace. For some industries in which Japan has challenged the world, the early results are in; the theory holds and continuous improvement works. Competitive organizations must develop strategies for improvement sufficiently early to enable them to stay in step with their competition. Those who procrastinate may find it nearly impossible to recover. As we enter the Information Age with its global marketplace, it is clearly in our national interest that domestic industry maintain world-class competitive ability.

While the U.S. defense industry and Government departments may feel a different form of competitive pressure than that experienced by the commercial sector, their continuous improvement is also in our national interest. The demands on our national resources will continue to grow. Taxpayers will increasingly insist that the Government accomplish its missions more efficiently and effectively. Top management in Government organizations must then come to grips with the theories that define their needs in order to improve and respond to those needs with philosophies and strategies that impel their organizations toward continuous improvement.

The organization that seeks to adopt a new philosophy for the Information Age must quickly come to grips with several broad issues: articulating an organizational purpose, communicating a vision of its future, undertaking an assessment of its values, and defining a unifying mission to which each member of the organization can enlist. These elements of the organization's philosophy should be thoughtfully and carefully crafted, officially codified, and broadly communicated both within and outside the organization.

PURPOSE

An organization must have a clear sense of purpose that is understood and shared by all its members. Organizations in the public sector need this sense of purpose as much as do those in the private sector. The purpose should be captured in a written statement crafted to provide continuity over a substantial time period. Dr. Deming, regarding his first of 14 points states, "Problems of the future command first and foremost constancy of purpose and dedication to improvement of

competitive position to keep the company alive, and to provide jobs for their employees."[1] A purpose statement should be simple and straightforward. For example, a statement might be a single sentence like, "Our purpose is to ensure long-term security for each stakeholder through continuously improving customer satisfaction and competitive position, increasing market share, employment opportunities and job security, and providing a competitive return on long-term investments."[2]

A purpose statement is generally drafted by a select team of top managers only after they have become thoroughly grounded in the principles and concepts of continuous improvement. That grounding helps ensure that they will give adequate consideration to each stakeholder in the organization, including those in the labor force. The purpose statements are designed to provide a stabilizing influence and to give continuity and direction to decisions and actions over the long term even during the constantly shifting tides of environmental change. Ultimately, a purpose is an ideal final objective, one that is never reached but that drives and frames all other organizational goals and objectives.

A clear and accepted organizational purpose is a rallying point for management and the work force. A properly constructed purpose statement should give each member of the organization a stake in its fulfillment. The purpose statement should persuade all members of their individual stakes and through them ownership in the organization's purpose. Therefore, CIP organizations reject shortsighted concepts of purpose and adopt ideas such as staying in business over the long haul, providing secure employment, and generating a fair and satisfactory return on investment for each individual with a stake in the organization. The new concepts of purpose foster decisions and behaviors that serve the long-term interests of all persons involved.

An organization's behavior should reflect and support its stated purpose. Those organizations that fail to articulate and pursue a clear long-term purpose are frequently driven by constantly shifting short-term issues and demands. Many

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[1]Deming, W. Edwards. *Out of Crisis*. Massachusetts Institute of Technology. Center for Advanced Engineering Study. Cambridge, Mass. 1985.

[2]A "stakeholder" is any individual or group with a stake in the success or failure of a given organization. In a company, the typical stakeholders would include employees, management, board of directors, stockholders, customers, suppliers, and the community in which it is located.

U.S. organizations typically seek to maximize short-term profit, a concept emphasized by many business schools. Decisions and behaviors based only on short-term results have led many companies to the brink of failure, a point that was aptly demonstrated by the U.S. automobile and steel industries during the 1960s and 1970s. Managers that practice hit-and-run behavior by operating without a long-term strategy make a significant contribution to the decline of U.S. competitiveness. Management must be held accountable for the long-term effects of its actions, and through a clear and present purpose that is kept alive by examination, discussion, and use as a decision-making benchmark, managers can be constantly reminded of their long-term accountability.

Finally, purpose may be conveyed through separate charter and mission statements. A charter statement defines the business. For example, the Harris Government Systems Sector charter states, "The Government Systems Sector provides communications, information, and automatic test systems, products, and services to the United States Government end-use marketplace." A mission statement may also identify a broad and unifying theme or goal that applies to everyone. Some examples of mission-goal statements might include establishing a culture of continuous improvement sufficient to compete for the Deming Prize or the National Quality Award within 5 years, increasing market share and building a base of customers who not only buy a product but brag about owning it, or fully engaging every employee and vendor in CIP within a specified time. Once management has defined the organization's reason for existence through its statement of purpose, it should next turn its attention to providing a vision of what it seeks to become.

VISION

The CIP organization's philosophy includes a clear and shared vision of where the organization is headed and what it is striving to become. The vision is documented, disseminated, and understood by every member of the organization. Most organizations fail to appreciate the importance of a shared vision in focusing the thinking and effort of their people. Ultimately, the vision should become both a corporate vision and a personal vision for the organization's members.

The vision establishes a desired future state for the organization. For example, the Harris Government Systems Sector vision reads, "We want GSS to be the

premier supplier, i.e., the supplier of choice in competitive procurement in each of our market areas as visualized by our customers, our employees and the Corporation. This reflects our image as well as the quality of our offering and product." General Electric's vision states in part, "All that we do must constantly strive to improve the value of our products. We satisfy our customers by understanding and meeting their needs, focusing on their expectations and treating them openly and honestly."

A vision should reflect an ideal for the organization. Examples are to be the recognized world leader in a chosen technology; to be the supplier of choice among a targeted customer base; or to become the premier model among public service organizations as visualized by clients, employees, and taxpayers. A common theme of vision statements is a striving for excellence, to be the best within a specific competitive field as defined by the customer.

The vision statement, like the purpose, is generally prepared by top management, e.g., the chief executive officer, the president, or a select management team. It must be crafted to be compatible with the purpose and must be relevant to each person involved. With purpose and vision statements in hand, management can next turn its attention toward clearly articulating its values.

VALUES

A CIP organization's values extend beyond the requirements for legal behavior to include the more nebulous realm of ethics. The CIP organization seeks to make clear that striving for improvement is bounded by expectations of ethical behavior. It seeks to communicate behavioral expectations to its employees through clear statements and management actions. The set of organizational values includes management's fundamental beliefs and expectations about fairness, honesty, and the rules of behavior. Those beliefs and expectations must be defined by the organization within its own context and not be a warmed-over rehash of someone else's values.

Values must be reinforced through the reward and recognition system, the signals communicated by management, and daily decisions and actions. A common theme among CIP organizations is that managers, employees, suppliers, and customers should all come to recognize that maintaining the highest standards of business conduct, ethics, and integrity is paramount and may be more important to

long-term business health than profit, schedule, or other measures of performance. The long-term survival of the organization and its business relationships depends on trust, respect, and good will. Condoned or systemic breaches of ethical behavior can quickly undo years of carefully crafted public perception.

Top management generally codifies its values both in its policies and in clear and simple statements about integrity. For example, General Electric states, "We are dedicated to the highest standards of integrity. We will be uncompromisingly ethical in all our dealings.... We will work together to create an environment of pride, fairness and open communications...." A CIP organization's policies make clear that unethical behavior will not be tolerated. Clearly stated policies also provide an important window through which to discern all aspects of the organization's philosophy.

POLICY

An organization's policies address a wide spectrum of issues and reflect a substantial cross section of its philosophy. The CIP organization deliberately examines its entire body of policy, both explicit and implicit, to assure that it is in harmony with continuous improvement. The policy review task is generally performed by a select management team that has been trained in the principles and practices of continuous improvement. Prior CIP training is particularly important for this effort, for the team members must have the knowledge and skills to recognize potential CIP roadblocks or counterproductive signals hidden in existing policies.

The existing body of policy may not be sufficient on its own to support continuous improvement. Separate policy statements may by needed to specifically address continuous performance improvement. For example, a formal, numbered Harris Government Systems Sector policy states, "It is the policy of Government Systems Sector to continuously improve performance in every area of our business. Continuous improvement shall be a vital part of our strategic planning..." Another company states, "It is the policy of the Florida Power and Light Company to pursue and deserve a reputation of Quality Leadership for all its services and products offered by providing them in a reliable, timely, efficient, and economic manner that will merit customer satisfaction."

The CIP organization creates policies to address the key topics for which clear guidance is required. However, it attempts to limit the proliferation of policies and

avoids overwhelming the work force with paper and rules. The policy review team seeks to streamline policy statements and to eliminate entirely any policies deemed unnecessary.

The philosophy of an organization as expressed in its purpose, vision, values, and policy statements is supported and bolstered by a more specific set of principles that govern and modulate day-to-day decisions and actions. These principles are explained in Chapter 3.

CHAPTER 3

PRINCIPLES

Principles are broad statements that provide a framework of general rules to shape organizational thinking. They apply equally to every area, function, and person in the organization. Fundamental management decisions affecting the organization should be tested against the core principles and rejected when found to be in violation of those principles. The CIP organization's principles are formally documented, widely disseminated, frequently discussed, and consistently deployed. They define the framework for judging behavior and the basis for assessing corporate culture.

The principles at the heart of CIP include (1) constancy of purpose, (2) commitment to quality, (3) customer focus and involvement, (4) process orientation, (5) continuous improvement, (6) system-centered management, (7) investment in knowledge, (8) teamwork, (9) conservation of human resources, (10) total involvement, and (11) perpetual commitment. These compatible and mutually supporting principles are discussed in this chapter.

The relationships among these principles deserves some discussion because their synergy is crucial to CIP success. The principles work together in a logical and holistic manner to give substance and vitality to the continuously improving culture. Figure 3-1 illustrates this holistic view.

Constancy of purpose and commitment to quality unite in an overriding, all-consuming focus on the organization's customers, their needs, and their requirements. This focus is translated into organizational practice through a process orientation, through continuous improvement, and through system-centered management. Individuals in the organization are empowered in these broad skills and their more specific subsets through an investment in knowledge that is realized through teamwork. Conservation of human resources assures the organization's most valuable asset – its people – remain as such. Total involvement in a perpetual commitment to improvement lays the groundwork for sustaining the effort.

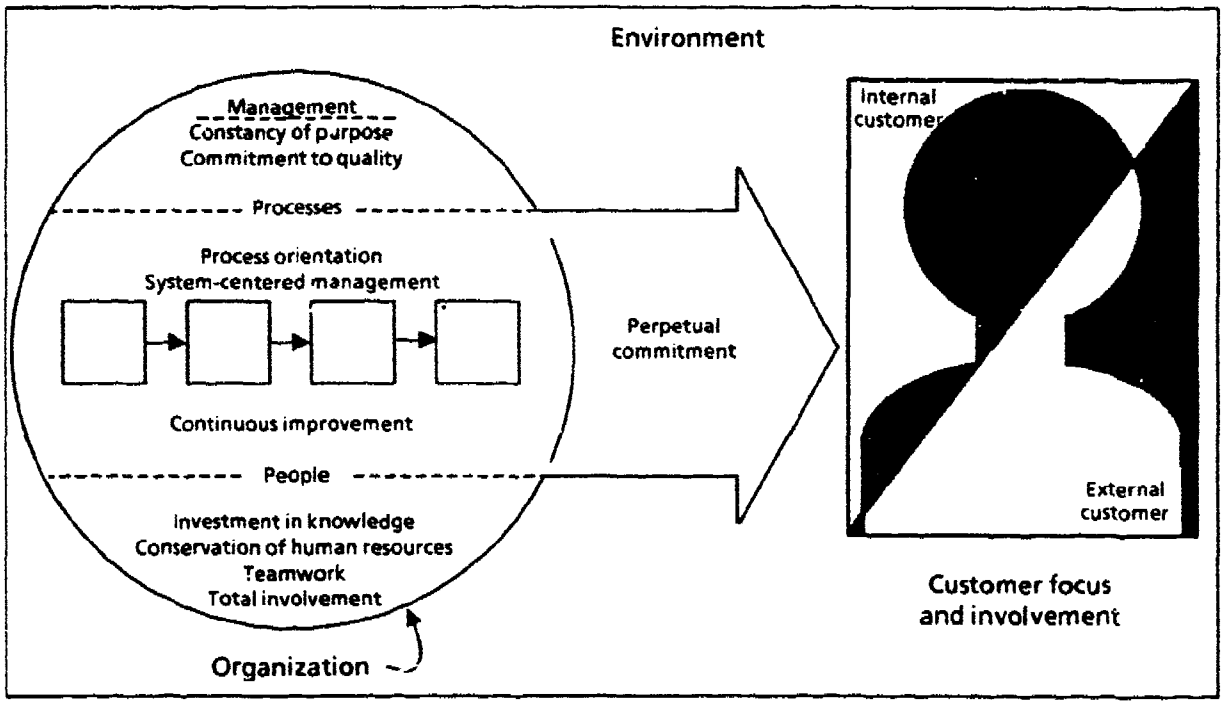


FIG. 3-1. HOLISTIC CIP VIEW

Other logical relationships exist among the principles, and the full range of their dynamic interplay is both subtle and complex. Experience indicates, however, that each principle plays an essential part in CIP success, and CIP failures can frequently be attributed to an inadequate application of one or more of these principles. Figure 3-2 shows some additional connective interrelationships among the various principles.

While the diagram may initially appear complex, the connections may be simply described as follows:

- *Constancy of purpose* is centered on promoting teamwork, *customer focus*, and continuous improvement.
- *Teamwork* is a major driver for investment in knowledge, which in turn fosters greater process orientation.
- *Process orientation* is the key to customer involvement and to focusing on the customer's needs and expectations.
- These needs and expectations impel teams toward *continuous improvement*, which is the manifestation of management's commitment to quality.

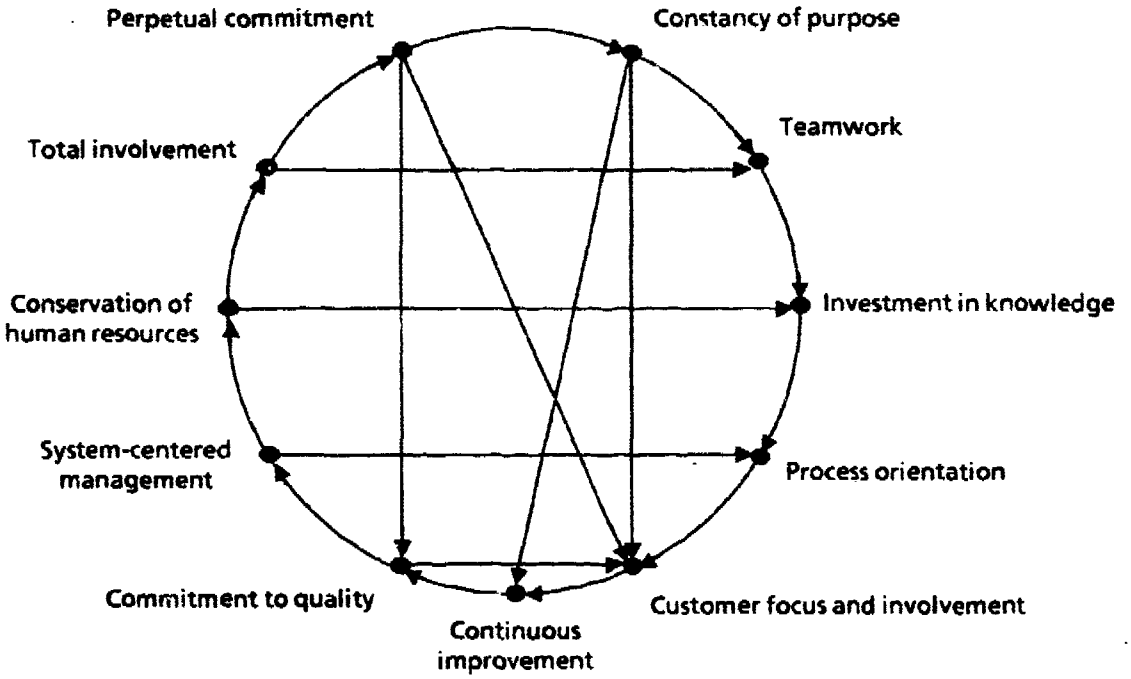


FIG. 3-2. CIP ELEMENT RELATIONSHIPS

- That *commitment to quality* requires managers to become system-centered and to concentrate on improving the systems they manage.
- *System-centered management* is both process-oriented and people-oriented and in its people-oriented role seeks to *conserve its human capital* through *investing in their knowledge* and seeking their *total participation* in team process-improvement activity.
- Finally, this total participation leads to the *perpetual commitment* of individuals and teams to quality and continuous improvement, which completes the cycle back to constancy of purpose.

The following sections discuss each of these principles.

CONSTANCY OF PURPOSE

The *constancy of purpose* principle is a core concept for continuous improvement. It is, in fact, the first of Dr. Deming's famous 14 points of management.[1] For the CIP organization, constancy of purpose is generally articulated by management through a broad statement of organizational purpose.

[1] Deming, W. Edwards. Ibid.

That statement provides individuals with a steady and consistent vision of where they are going, what is expected of them, and what they expect of themselves. Likewise, a constancy of purpose demonstrated consistently by management's behavior enables each individual to construct a reliable mental road map on which to base his/her decisions and actions.

As shown in Figure 3-2, three key principles are closely linked to constancy of purpose: teamwork, customer focus and involvement, and continuous improvement. Those principles should ideally be implied by the organization's purpose statement. Additionally, they are difficult or impossible to sustain in an organization that lacks a constant purpose. For example, continuous improvement most often results from a long series of small and deliberate process changes. Planning and guiding those process changes for optimal effect toward a common goal requires a stability of purpose over time. Without a stable framework of purpose, improvement decisions and actions can conflict and the effort expended on continuous improvement may not be optimal.

Top management is responsible for providing constancy of purpose. It must be provided from the highest possible level so that it can be infused throughout all parts of an organization. It is conveyed by a clear statement of a "vision for the organization" with a set of consistent goals and objectives and is supported by strategic and tactical plans. The constancy of purpose is reinforced by an ongoing stream of management signals and actions that nurture and support the realization of the vision.

An organization displaying constancy of purpose will have the following elements:

- Documented, well disseminated statements of purpose and vision
- A set of long-, medium-, and short-range goals and objectives clearly linked to the purpose and vision
- A set of strategic and tactical plans as road maps for achieving the goals and objectives
- A consistent awareness among all organization members of the purpose, vision, goals, objectives, and plans and of their personal roles in achieving them

- A shared belief among organization members that management's behavior clearly signals its commitment to, and supports the achievement of, the vision.

Constancy of purpose is supported by (1) planning, (2) goal setting, (3) policy deployment, (4) perpetual commitment, (5) efficient resource allocation, (6) economic implementation, and (7) long-term contracting.

COMMITMENT TO QUALITY

Commitment to quality is a cornerstone of the continuous improvement culture. However, many organizations experience difficulty in defining *quality*. Their definitions range from very narrow ones such as "conforming to specifications" to the very broad ones such as "an intangible but perceived inherent goodness." In the context of continuous improvement, *quality* must embrace these extremes and everything in between. Because a customer's overall perception of quality is formed from a complex integration of many factors, defining it simplistically would be a strategic error. A simple definition that limits management's apparent responsibility for quality serves only to lull the organization into falsely believing it has quality under control.

The concept of quality improvement must encompass both measurability and the customer's perceptions of usefulness. Improvement implies a comparison with past performance. Quality improvement implies increasing degrees of excellence with reference to specific and accepted points of reference. Those points of reference include specifications, cost, performance, schedule, responsiveness, and the available competitive alternatives. Finally, *quality* must address not only the organization's products and services but also the organizational processes from which they result.

A commitment to quality must begin with top management. Consistent with its constancy of purpose, working within the corporate philosophy, top management must identify the external customers for the organization's products and services. Top management must understand the customer's needs and expectations and assure that they are translated into the attributes and characteristics of the products or services. Top management must direct the resources of the organization toward continuously improving the product or service with respect to the customer-relevant attributes.

To commit to quality means to commit to constantly improving every process, enhancing its resulting product or service with respect to any and all factors identified as relevant to customer perceptions of excellence. That means much more than simply complying with specifications themselves. It requires improving the specifications, reducing cost and processing times, enhancing communication, and simplifying processes when doing so will enhance the customer's overall perception of excellence. Quality is the sum of the impressions made on the customer that influence his judgment and decisions about a product or service. That which is considered by the customer to be of high quality at one time may be viewed as poor quality in a different time or context. Since the customer's perception of quality is constantly evolving, the CIP organization must have a means of continuously staying attuned to the voice of the customer.

To commit to quality also means to commit to fostering productive change in all the products and services produced by the organization. Changes are made in response to customers, and they should also be targeted to produce desired response behaviors in customers. Changes that produce no response behavior in any customer have little apparent value. However, customers respond to generalized impressions of quality so it may not always be feasible to predict specific customer responses. Therefore, some means of quickly and efficiently estimating the probable effects of a change on customer's quality perception may be required to discriminate among the change options.

Finally, a commitment to quality requires the serious study of processes to understand their relationship with quality. For example, the level of inventory has a direct bearing on quality. A large inventory is subject to higher degrees of handling damage and degradation through aging, as well as adding to product cost by increased overhead. A large inventory also tends to mask many production process problems and inefficiencies that may actually degrade quality. The design process is another area that is strongly linked to product quality. If the design parameters and tolerances are not carefully selected, the product may not be sufficiently robust to meet a broad range of diverse customer requirements.

Traditionally, higher quality has been equated with higher cost and longer development time. In a CIP organization, the opposite is true. High-quality products flow from high-quality processes and high-quality processes, by definition,

produce the right things correctly the first time with minimal scrap, rework, or waste, and require minimal inventory, time, and cost.

An organization that commits to quality will have the following elements:

- A clear statement and ongoing visible actions from top management that reflect the organization's commitment to quality through fostering change for continuous improvement
- A strategy for identifying customer needs and expectations and for translating them into guidance to focus decisions and change action
- A means to disseminate within the organization the attitudes and behavior that are consistent with a commitment to quality; that is, those that will result in continuous improvement in the product and service attributes that have relevance to the customer
- A dynamic and structured process for examining and improving all major processes including design, manufacturing, inventory management, service, and administration.

The principle of commitment to quality is supported by (1) customer research, (2) open communication, (3) quality function deployment, (4) robust design development, and (5) inventory reduction.

CUSTOMER FOCUS AND INVOLVEMENT

Without customer focus and involvement, both constancy of purpose and commitment to quality become meaningless. Attracting, serving, and retaining customers is the ultimate purpose of any organization, and those customers help the organization frame its quality consciousness and guide its improvement effort. A process, product, or service has no relevance without customers; everything done in a organization is done for a customer. The quality of a product or service is defined by customer behavior and response. Process improvement must be guided by a clear understanding of customer needs and expectations.

Increased customer satisfaction is the ultimate result of customer focus and involvement. The responsibility for assuring customer focus and involvement starts with a top management focus on the organization's external customers and extends down through every level of activity to involve all customers in the improvement process. CIP emphasizes satisfying all customers, internal and external. Every employee is both an internal customer for other company processes and a producer.

Each producer must know his customers (internal and external) and establish meaningful channels of communication with them. Once customer needs and expectations are defined, they must be translated into measures of performance and directly related to the processes that create products and services.

Just as the organization is dynamic, so are its customers. Customer requirements change for a variety of reasons, often uncontrollable and unpredictable. To serve its customers adequately, therefore, the organization must continually reassess its customers needs and requirements and factor them into its improvement efforts. Failure to consider customers and to actively involve them in the improvement effort is a fatal flaw in any organizational philosophy.

An organization that focuses on its customers and involves them will have the following elements:

- A clear identification of its external customers
- A current and accurate means for assessing external customers' needs and expectations with respect to the offered products or services
- A set of performance measures that indicates the external customers' response to those products and services
- A means for identifying internal customers and defining their needs and expectations
- A set of performance measures linked to the internal products and services to indicate the degree to which internal customer requirements are satisfied
- A means to integrate and ensure the alignment of internal requirements and measures with those of the external customers.

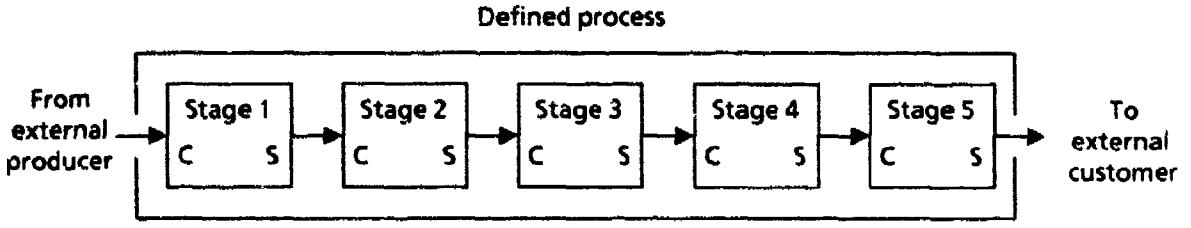
The principle of customer focus and involvement is supported by (1) policy deployment, (2) customer research, (3) customer polling, (4) team building, and (5) process standardization.

PROCESS ORIENTATION

The most effective means for an organization to address customer needs and improve itself is to focus improvement efforts on its processes. Process orientation requires a significant change in thinking for many Western managers. Western management practices, particularly quality functions, have traditionally focused primarily on the postproduction identification and rejection of defective products.

While that approach may be reasonably successful in preventing unsatisfactory products from reaching customers, it does little to change the processes that create defects.

Continuous Improvement Process forces management to think in terms of process rather than in terms of finished product. Everything that is done in an organization is accomplished through a process comprised of definable stages, steps, or activities. As illustrated in Figure 3-3, each step of a process is a producer and a customer. The customer is always the step subsequent to the producer. Hence, the principle of customer focus and involvement provides a precise means for defining the purpose (and often the means) of the process.



Note: C = internal customer; S = internal producer (supplier).

FIG. 3-3. PROCESS CUSTOMER/SUPPLIER RELATIONSHIP

The quality of the products and services delivered is a direct result of the quality of the processes that produce them. Product defects occur because of defective processes. Correcting defective products through scrap and rework is extremely costly. Correcting defective processes is both more intellectually challenging and more cost-effective in that it prevents future defects and eliminates the costs of inspection and correction activities that do not add value to the product. For example, consider a wave-soldering process that consistently produces defective solder joints, which are then routinely reworked by a touch-up team. The labor of the touch-up team is pure waste and its cost is added to the cost of the product. That situation does not improve until someone discovers that a temperature setting called for in the soldering instructions is incorrect, amends the setting, and permanently resolves the problem. After the process is corrected, the touch-up team is no longer required. Process quality improves and cost decreases accordingly.

In a product-oriented regime, postproduction inspection is used by quality-control personnel to sort good products from bad. Under a process orientation,

however, performance measurement is used by the production personnel to verify that their processes are operating as they should. Process knowledge enables an individual to identify or even anticipate problems from measurement data and to take timely corrective action. Statistical techniques for process management can help improve processes, reduce defects, or prevent defective products from being produced and can improve, cost, leadtime, reliability, and other factors important to customers. A major difference between a postproduction inspection approach and a process-oriented approach lies in the collection, timing, feedback, and management response to measurement data.

An organization that focuses on processes will have the following elements:

- Personnel trained in process analysis and familiar with the process in which they work and for which they are responsible
- All processes documented by process flow diagrams and written process descriptions
- Customers identified for each stage of a process and their needs and expectations defined for the products or services they receive
- Performance measures that indicate process adequacy defined for each process stage
- A means for using product and process measurement data systematically to control and improve process performance.

The principle of process orientation is supported by the practices of (1) process-improvement-team creation, (2) training, (3) process standardization, and (4) process simplification.

CONTINUOUS IMPROVEMENT

Continuous improvement is the fundamental principle around which CIP is centered. It complements and animates the principles of process orientation and customer focus and involvement with the certain recognition that no process, product, or service ever attains perfection and that neither the customer's expectations nor the quality of the competition remains static. A deliberate positive change (improvement) is required to win and hold a customer base or to remain economically competitive. Devotion to continuous improvement is a demonstration of constant, purposeful commitment to quality.

Continuous improvement depends on both innovative and small incremental changes. Innovation is characterized by large dramatic changes resulting from new technologies or new ways of thinking and is often the product of research and development. The introduction of an innovation often raises performance to new levels; however, the new standard of performance can rarely be sustained without a concerted maintenance effort. As a consequence, performance levels tend to subside somewhat after the introductory period, as shown in Figure 3-4.

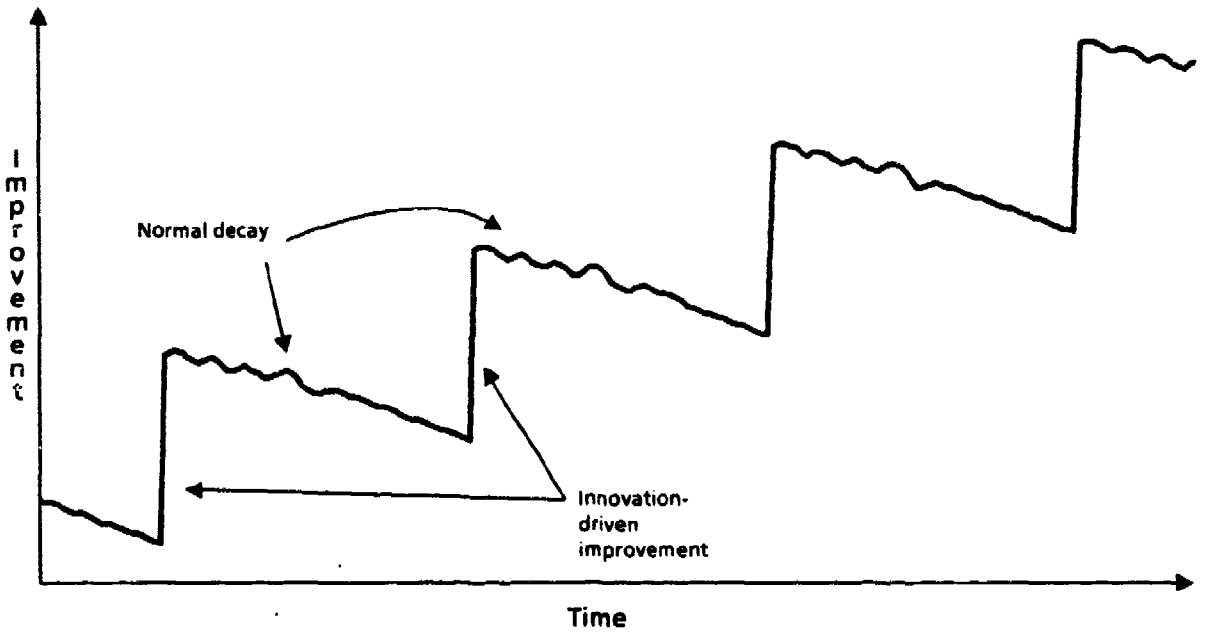


FIG. 3-4. INNOVATION-DRIVEN IMPROVEMENT

Western management has traditionally focused on innovation as the primary engine of improvement. The CIP organization also recognizes the importance of innovation for developing new processes, products, and services. It also recognizes small incremental improvements as essential for maintaining and building on the new performance standards achieved through innovation, as illustrated in Figure 3-5. CIP organizations seek a better balance between innovation and small incremental improvement.

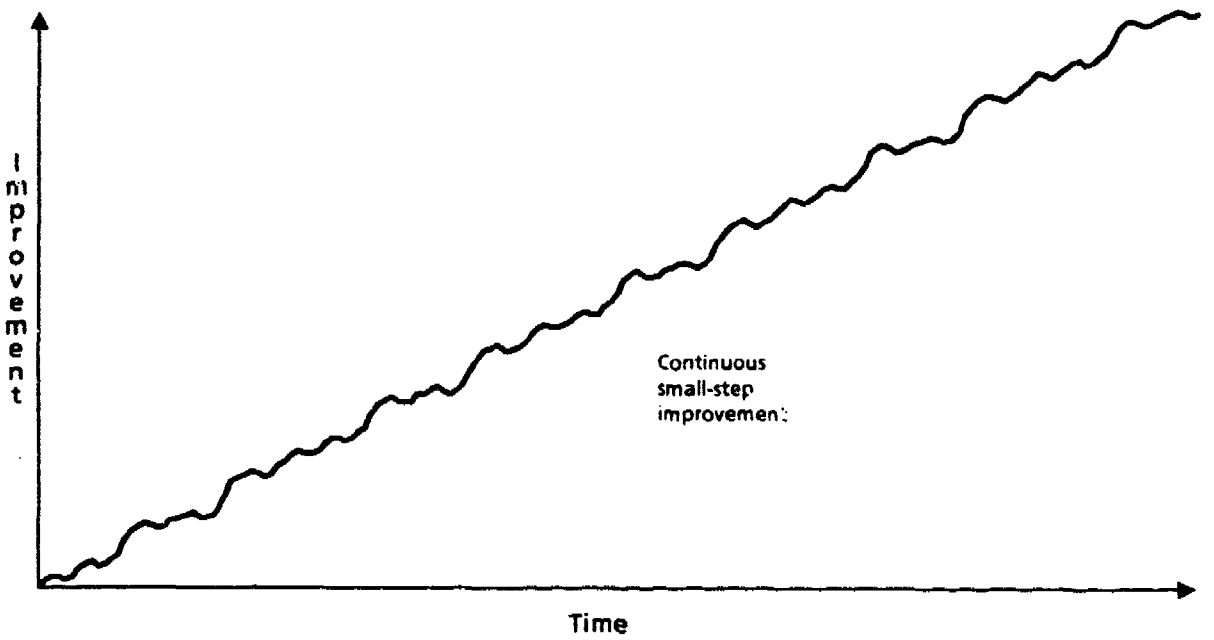


FIG. 3-5. SMALL-STEP IMPROVEMENT

Frequently, the savings that accrue from small incremental improvements and reduced waste can be directed toward funding more and better research, which can lead to deliberate, directed innovation. Management, therefore, needs to consciously integrate frequent incremental small improvements and large innovative changes to optimize competitive advantage.

Eventually the opportunities for small incremental process improvements reach a point of diminishing returns. Before that occurs, the organization should be prepared to introduce the next level of innovation and to begin again the incremental improvement cycle. The balance between innovation and incremental improvement is key and is illustrated by the growth curves in Figure 3-6.

The period immediately following an innovative change in a process or product is generally characterized by a large amount of process variation, which is responsible for waste and defects. By applying techniques to reduce variation and eliminate waste, the process can be constantly improved. The customer can thus be provided with ever- increasing quality at lower cost.

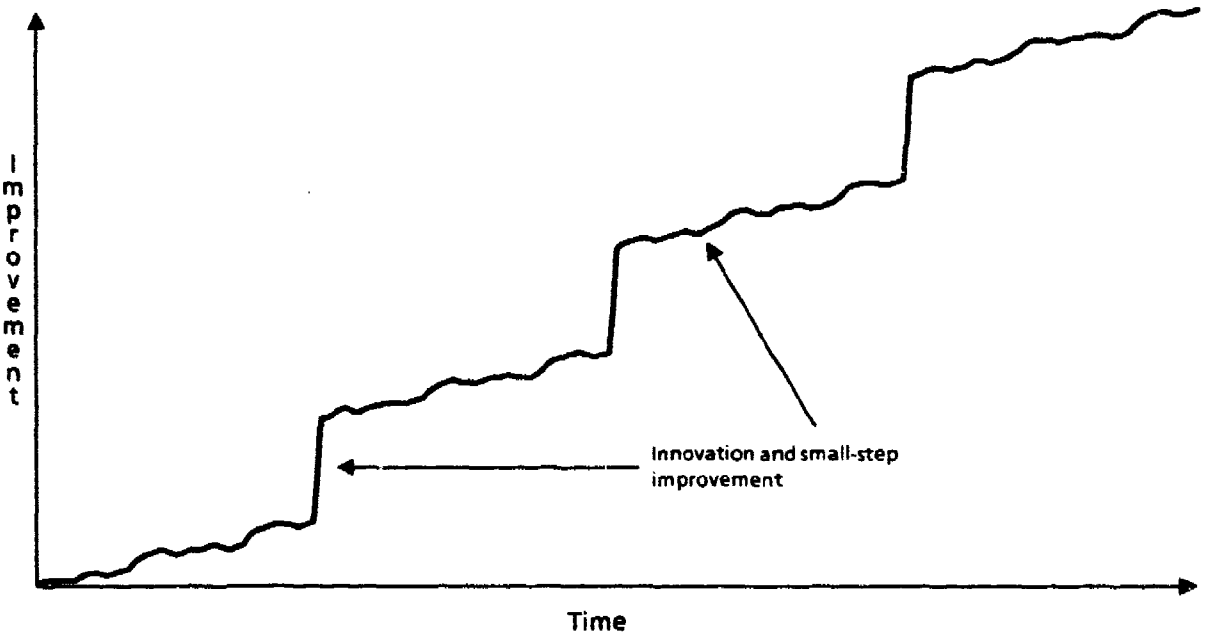


FIG. 3-6. INNOVATION PLUS SMALL-STEP IMPROVEMENT

The essence of continuous improvement is nicely captured in the Japanese concept of *Kaizen*, which means "continuous improvement by doing little things better, and setting and achieving ever-higher standards." The strength of continuous improvement lies in the cumulative effect of its many small changes, which can occur so frequently but in such small increments that the steps are not readily visible. It has been said of Michelangelo's Sistine Chapel that, "The approach to perfection is through millions of trivial strokes, yet to approach perfection is by no means trivial." This is the essence of continuous improvement.

An organization pursuing continuous improvement will have the following elements:

- An improvement strategy that integrates and stimulates incremental changes with the innovation process.
- A management team that is sensitive to and eager to listen to even the smallest ideas or suggestions for improvement.
- A training program to educate all employees in the principles, techniques, and tools that support the incremental improvement process.

- A means to quickly and easily facilitate a continuous stream of many small improvements. This means moving the authority to screen and approve simple change actions to the lowest organizational levels possible.

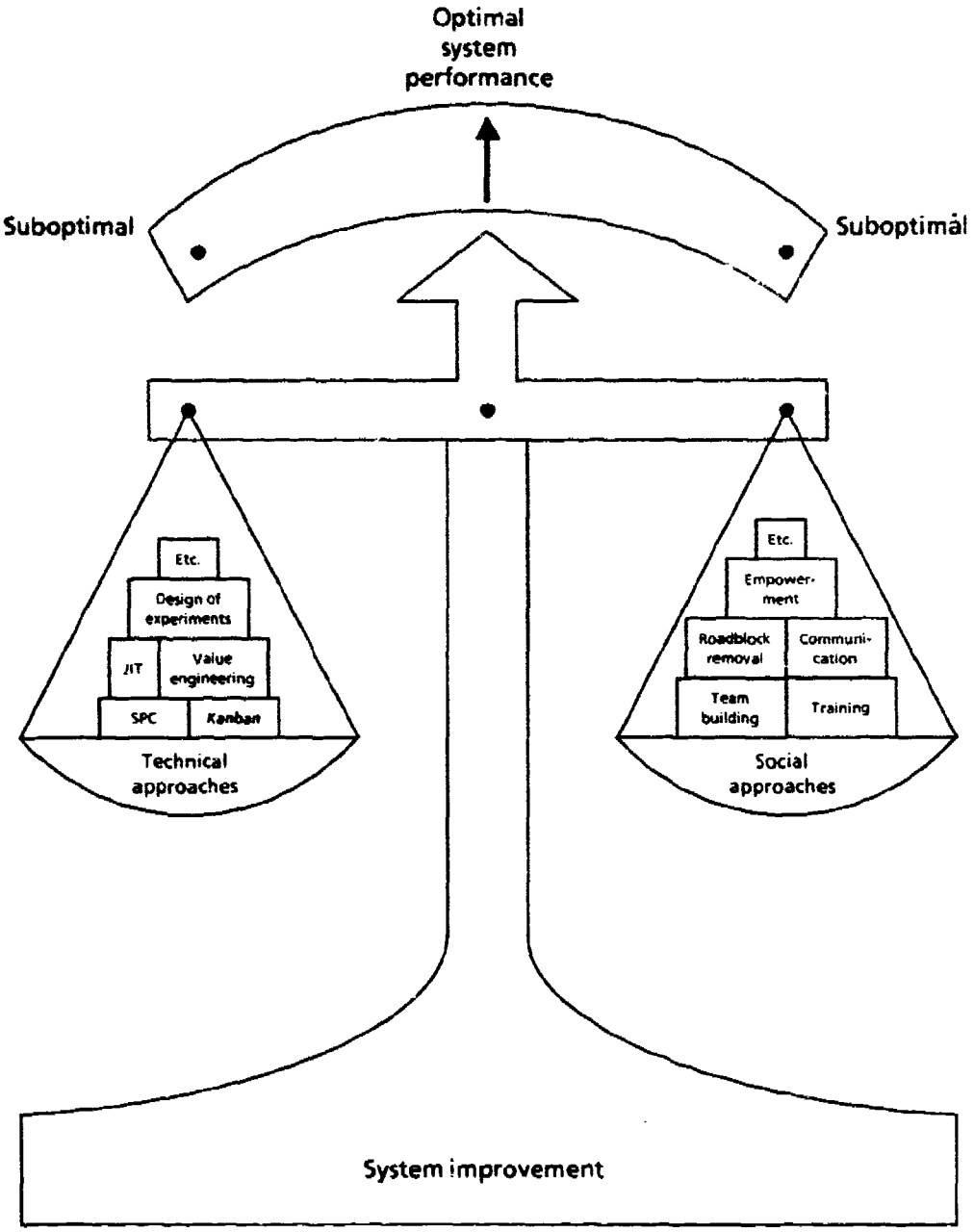
The principle of continuous improvement is supported by (1) innovation, (2) improvement projects, (3) performance measurement, (4) variation reduction, (5) vendor base reduction, (6) defect prevention, and (7) upstream management.

SYSTEM-CENTERED MANAGEMENT

System-centered management requires managers to actively improve the system within which they work. Management's new job, according to Deming, is to study and reform the processes by which work is accomplished. This concept is anathema to many Western managers. Many managers come to their positions with the idea that their job is to assure that work is accomplished in accordance with established processes. They tend to see their role as keeping people busy and processing the paper that constitutes their deliverable products. True, a substantial part of their job is motivating the work force, providing better discipline, hiring better people, or performing administrative tasks. However, when managers assume that the fundamental structure and processes of the system are fixed and correct, they fail to address their most important job, system improvement.

The traditional attitude about management's role leads managers to deal with a continuous stream of momentary demands for attention. The demands of the "in-basket" never cease, squeaky wheels constantly need oiling, and most managers get bogged down in detail and are unable to step back and deal with the entire process or system. The manager becomes a mechanic, so busy tinkering with the sources of noise that he cannot see that the machine, the organizational system, is becoming obsolete and incapable of performing to modern standards.

All the CIP principles, particularly those of commitment to quality and continuous improvement, demand that management attend to the larger, global needs of the system. The system-centered management principle requires managers to devote sufficient time to addressing system performance. Optimum system performance is achieved through a balanced application of technical and social approaches to improvement as illustrated in Figure 3-7.



Note: JIT = just-in-time; SPC = statistical process control. ***Kanban*** is an inventory control technique explained in Chapter 4.

FIG. 3-7. BALANCED APPROACH TO SYSTEM IMPROVEMENT

The system-centered manager recognizes that achieving optimum system performance requires integrating technical approaches such as computer-aided processes, new machine tools, and robotics, with social approaches such as training, teamwork, and performance incentives. Continuous improvement can only address systems when it fully recognizes their many interrelated parts. Subtle system elements such as signals and feedback are just as important as the more tangible mechanical process stages.

In addressing system improvements, management should avoid focusing too quickly on individual solution techniques and tools such as statistical process control, just-in-time (JIT), or automation. Organizations that converge too quickly on the application of tools tend to miss the larger perspective of how all the system elements should ideally play together. The failure to focus first on understanding and simplifying existing processes leads many organizations to institutionalize flawed processes in new technologies.

Managers need to encourage their subordinates to identify problems, to work with them to solve the problems, to help them to better understand their processes, and to train them to employ methods for process improvement. Making improvements at the system level must become one of the priority measurement criteria of a manager's performance. One important indicator of successful system improvements will be a marked decrease in the firefighting and in-basket demand that had earlier been so all consuming of management's time. Just as one might say, "Take care of the processes and the products will take care of themselves," so might one say, "Take care of the system and the fires will take care of themselves."

An organization focusing on systematic improvement will have the following elements:

- A clear policy statement that managers own their processes and have a responsibility for assuring the continuous improvement of those processes in line with the realization of organizational goals
- A functioning network of management teams that meet regularly to deal with the issues of system-level improvement
- An explicit component of the management reward and recognition system that addresses and stimulates system-level improvements

- A continuity of signals from top management indicating that eliminating the potential for fires is in the long run more important than fighting fires.

The principle of management working on the system is supported by (1) policy deployment, (2) team building, (3) process analysis, (4) line responsibility and authority, and (5) roadblock and bottleneck reduction.

INVESTMENT IN KNOWLEDGE

While the previous six principles have emphasized philosophic, procedural, or systemic concepts, this and the next four principles are effected more through individual action. People in the organization must be empowered to effect CIP. Personal knowledge, teamwork, security, and personal involvement are among the key factors that govern how individuals function and interact within the organization. Expanding knowledge is both a personal and an organizational responsibility. Both the individual and the organization must commit to investing in knowledge.

Investment in knowledge is aimed at maximizing human potential and capital. All planned improvement comes from growth in understanding. Improvement is achieved through questioning why things are done and the ways they are done, by trying new ways of doing things, and by learning. Increased education and knowledge should be a lifelong opportunity and experience. In the work place, every employee should be challenged to grow in value to the organization and in self-worth. An organization that practices CIP makes this growth happen!

Top management is responsible for maximizing its human capital by investing in knowledge. Management must make the education and training opportunities available, provide the media and the means, stimulate the employees' desire to learn, and manage the delivery and application. Continuous improvement requires a strong emphasis on education and training. Each employee who understands the work process better and builds job skills and abilities will become better able to recognize problems and eliminate them. Too frequently management views training as an expense rather than an investment. When appropriately managed, an investment in employee knowledge will consistently return a handsome interest.

A successful CIP organization creates a wide variety of training opportunities, makes them available to every employee as appropriate to the job, times their delivery to maximize effectiveness, measures success by application in the work

place, and reinforces the training process through the reward and recognition system.

An important feature of successful training management is providing training just in time for application to the job. Just-in-time training is delivered in small bites and is immediately applied on the job. For example, an individual who is instructed in the proper application and use of a statistical control chart is then required to institute and use a control chart on some appropriate process parameter in his/her work. The chart then becomes part of the improvement effort on his/her process. Only after the worker has successfully demonstrated a practical understanding of using control charts on the job is he/she ready for the next training topic. This method strongly reinforces the learning process and makes the most effective use of training resources. Training that is not timed for direct application on the job is frequently forgotten or never used.

Many organizations make the mistake of committing to a training program, conducting mass training, and measuring success by the numbers of people trained. That approach is generally wasteful and ineffective unless each individual can and is required to immediately apply the knowledge gained to his work. Such is rarely the case in classroom mass training situations. The numbers of people trained in a topic is a relatively meaningless statistic. What matters is the number of trained people who successfully apply their new knowledge to improving their processes or products.

An organization that invests in knowledge and appropriately employs training for improvement will have the following elements:

- A vigorous training program with the appropriate staff, materials, and support. It should range from orientation for new employees to technical training for engineers and skills training for managers.
- A means of measuring training effectiveness in terms of increased job performance.
- A just-in-time policy and plan for training that enables continuous improvement in the skills and knowledge inventory of every employee.
- A reward and recognition system that encourages and acknowledges the intellectual contributions and achievements of all employees. Small ideas and improvements ought to be appropriately recognized as surely as big ones.

The principle of investment in knowledge is supported by (1) training, (2) facilitation, (3) communication enhancement, (4) use of consultants, (5) internal assessment, and (6) external assessment.

TEAMWORK

Although knowledgeable, skilled employees are crucial to the improvement process, the individual skills they provide may be substantially leveraged when employed in the context of teamwork. Teamwork is essential to the success of the CIP culture in an organization. One universal goal is to ultimately involve every member of the organization in process-improvement-team activity. Team networking begins with the creation of an Executive Steering Committee (ESC) that is initially chaired by the top leader in the organization and is made up of his direct reporting staff.

Some organizations use another approach, one in which top- and mid-level teams must have representation from at least three levels of management and in which the team chairmanship must be rotated among team members in the second and subsequent years. In general, teamwork does not necessarily imply that new organizational entities must be created. Rather, in most applications it means that existing groups will begin working as teams, using the techniques that take advantage of interpersonal dynamics.

The ESC shapes and leads the CIP cultural deployment process. It defines the overall goals and objectives of the organization, develops and promulgates a strategic improvement plan, and demonstrates commitment through active and continuous involvement in the improvement process. Team interaction principles and practices govern ESC operations as they govern those of all teams.

Each ESC member in turn heads one or more second echelon teams that translate the top-level goals, objectives, and strategy into more specific goals and objectives, deploying CIP into his/her respective areas of responsibility. Interlocking process-improvement-team structures are built down through the organizational echelons, eventually translating goals into action, until all employees and all processes engage in improvement team activity.

Most process-improvement teams mirror the natural function or work group structures and thus overlay the existing organizational hierarchy. Additional teams

are created to ensure cross-functional process improvement and attention to processes of special interest or broad application such as reward and recognition or quality-of-work-life issues.

For the most part, creation of the team network flows from the top down. Training team members within the team setting is an integral part of the deployment process to produce what H. James Harrington, author of *The Improvement Process*, calls a "waterfall effect" that systematically washes out the counterproductive ideas and signals as the culture is deployed down into the organization.

Each team, once created, engages in ongoing process-improvement activity that is appropriate to its level and area of responsibility. These activities include customer recognition, process definition, performance requirements definition, performance measurement and assessment, and process-improvement-cycle activity. Statistical techniques are an integral part of every team's performance measurement activity. Statistical information provides a common language for the examination of process performance and for the assessment of improvement efforts.

An organization that promotes and practices teamwork should have the following elements:

- A policy governing the creation and operation of process-improvement teams, including all personnel and all processes
- A top-down structure of integrated process-improvement teams, including cross-functional and special teams
- A mechanism to assure that all the teams engage in process-improvement activity appropriate to their level on an ongoing basis
- A reward and recognition system attuned to team performance.

The principle of teamwork is supported by (1) team seeding, (2) team building, (3) cross-functional integration, (4) training in team settings, and (5) reward and recognition of team performance.

CONSERVATION OF HUMAN RESOURCES

Consistent with, and embedded in its constancy of purpose, the organization must recognize that its people are its most important asset. This recognition is rooted in the principle of conservation of human resources. Often management

behavior does not reflect an appreciation of this principle. Work force reduction is frequently the first avenue of cost reduction. Rank and file employees are too frequently perceived as pairs of hands or strong backs with too little regard for the available mind.

An enlightened and consistent approach to leadership is a cornerstone of every successful CIP application. All of the leaders in the field, including Deming, Juran, Drucker, and Crosby, stress the importance of creating a stimulating, secure, and supportive environment in which teamwork, creativity, and pride of workmanship can thrive. Without this environment none of the other elements of CIP can be totally successful.

In a process-oriented organization, the minds of the individuals who are engaged in a process are the best source of ideas for improving that process. Not tapping and using the intellectual capacity of the minds of employees is a waste of available resources. Additionally, experience has clearly shown that employees who are treated as whole persons, and are given the opportunity to express their ideas and to influence their work environment are happier, more loyal, and more productive.

The principle of conservation of human resources requires management to create a working environment in which each individual is encouraged to think about ways to better accomplish work. Management stimulates, recognizes, and rewards the intellectual potential and contributions of all its people as overtly as it does the mechanistic performance of routine labor. In difficult times management exhausts every available avenue for cutting costs or realignment before resorting to traumatic work force reductions.

Conservation of human resources requires management to embrace the principle of investment in knowledge, including providing retraining when old skills become obsolete. It also includes moving people into alternative productive employment, including equipment maintenance and working on systemic processes, during slack periods in their primary job area. It involves seeking creative solutions with labor, such as job-sharing or across-the-board temporary wage reductions for all personnel including management, in lieu of forced personnel reductions.

A key message of the principle of human resource conservation is, "We expect the best from our people and we give them our best in return." The creation and maintenance of a work environment that is compatible with a CIP culture is absolutely a top management responsibility.

An organization that is concerned about human resource conservation will have the following elements:

- A clear, visible, and enforced policy that people are the organization's most important resource and as such will be treated with respect and helped to grow in a challenging and secure environment
- A process for educating employees about team dynamics and appropriate and expected interpersonal behavior
- A means of monitoring and measuring the quality-of-work-life factors and for providing for feedback and improvement
- A bias toward investing in people, providing training, creating opportunity, unlocking talent, driving out fear, breaking down barriers, opening communication channels, and listening
- A policy that personnel reductions will be the last avenue of recourse when seeking cost reductions.

The principle of conservation of human capital is supported by (1) policy deployment, (2) training, (3) team development, (4) reward and recognition, (5) celebration, and (6) gain sharing.

TOTAL INVOLVEMENT

Ultimately, all the CIP principles will guide the actions of every person in the organization. The principle of total involvement (participation and empowerment) addresses this universal involvement in CIP. It is concerned with ensuring continuity of appropriate signals throughout the organization and realizing process-improvement benefits in every area of activity. Total participation means that every individual gets involved and has a responsibility to seek continuous improvement at both the individual and team level. Total empowerment means that individuals are given the necessary authority to make decisions and initiate improvement actions within their own work areas and expertise. Employees are encouraged through respect and trust to exercise self-direction and self-discipline. Empowerment is a source of pride, a wellspring of creativity, and an engine for improvement action.

This empowerment is essential if the principle of total involvement is to be followed. Participation and empowerment are stimulated, nurtured, and guided by management involvement, teamwork, clear objectives, and vigorous open communication.

As stated in the principle of commitment to quality, the responsibility for quality and improvement cannot be delegated. It is part of every individual's job, from the chief executive officer to the janitor. Total participation and empowerment is an ideal that may never be fully realized given the normal turnover and disruption in an organization. However, participation rates between 80 percent and 95 percent of all employees are entirely feasible. The participation level for top managers should be targeted at 100 percent and once attained should be diligently maintained.

In the implementing organization, involvement and empowerment should begin at the top and flow down into the organization. Managers and supervisors should practice CIP fundamentals before expecting their subordinates to practice them. The process of gaining total participation relies on supervisors to demonstrate appropriate behavior and then to become actively involved in the education and training of their people.

Once a part of the organization has become involved, empowered, and active in CIP, management must assure that appropriate mechanisms are in place to sustain ongoing involvement. Process orientation and continuous improvement must be actively encouraged and nourished. Many organizations become so enamored of starting new areas that they neglect those already under way. Team and individual improvement activity will soon disappear unless they are nurtured by attentive management.

Teamwork, structure, and discipline play an important role in sustaining involvement and empowerment. Structure is provided, in part, through the integrated network of process-improvement teams articulated in the principle of teamwork. Discipline is provided through the use of specific techniques like improvement projects, *Plan-Do-Check-Act* (PDCA) cycle techniques, or Genichi Taguchi methods of design. (The Taguchi Method is described in Chapter 4 in the section "Support of Commitment to Quality" in the subsection on "Developing Robust Designs" on page 4-86) In a typical CIP organization, teams meet regularly at specified times to work on process-improvement issues. Each team always has a

specific improvement project or goal on which it is actively working. Improvement projects are defined with limited scope so that they can be accomplished or at least so that initial solutions may be implemented within 3 to 4 months. Teams are required to present the results of their effort to their parent team at the end of a project cycle.

A substantial portion of the improvement ideas flow from the minds and job actions of empowered individuals. A responsive process for capturing and implementing suggestions is essential for vigorous involvement of individuals. The regular involvement and stimulation of team activity, however, also plays an important role in the generation of individual initiatives.

Consultants and practitioners disagree about whether team activity should be mandatory or voluntary. The principle of total involvement and empowerment favors mandatory participation in the improvement team activity associated with an individual's natural work group. Involvement in the activities of special and cross-functional teams, however, is generally voluntary or ordained by the expertise of the team members.

Many organizations have experienced difficulty when implementing improvement techniques in areas lacking total participation. If whole levels of management or critical functional areas are left out of the deployment process, those areas are a potentially deadly source of anti-CIP signals and roadblocks. Middle management, in particular, must be an integral part of the process.

Finally, total participation extends to the union management and to suppliers. Improvement teams should include representatives from organized labor and supplier organizations when they play a role in the team's target process. This participation requires a significant change in mind set for many organizations. The development of teamwork with persons traditionally viewed as outsiders, or worse as adversaries, requires true cultural change. Yet, organized labor and suppliers have proven to be rich sources of improvement ideas and problem solutions.

Including organized labor and suppliers in the improvement process often requires the disclosure of internal information traditionally not shared. Internal management problems are often considered "dirty linen" to be kept hidden. The development of trust is the key to open communication. Most organizations will explore improvement opportunities in low sensitivity areas first and concentrate on

fostering trust-building experiences. Successful efforts build team spirit and open doors for greater engagement.

An organization aiming toward total participation and empowerment will have the following elements:

- A clear policy statement that makes total participation an organizational goal
- A strategy for the orderly deployment of a CIP culture into the organization in a way that achieves the "waterfall effect" of training and team activity involving everyone
- An explicit expectation communicated through the signals from top management that participation in the improvement process is part of everyone's job and is demonstrated through both team and individual behavior
- A structure of process-improvement teams that are linked and interact to reinforce and sustain improvement activity
- A disciplined approach to improvement that includes goals, projects, and the repetitive application of rigorous and defined techniques
- A plan for the engagement of organized labor and suppliers in the improvement process and inclusion in team activity.

The principle of total participation is supported by (1) policy deployment, (2) team creation, (3) training, (4) universal participation, (5) improvement idea generation, (6) vendor participation, and (7) union participation.

PERPETUAL COMMITMENT

Perpetual commitment makes it clear that CIP is not a program that has starting and finishing points; rather, it is a process that, once begun, will be used by the organization to conduct all future business. Commitment is a management action that implies a management responsibility to encourage and facilitate positive change even when such change is difficult, time-consuming, or lacking immediate return on the investment. Commitment is measured by behavior: it means holding a steady long-term course in the face of short-term pressure; making improvement the top agenda item in communications and decisions; being willing to invest for the long-term benefit; supporting the creative improvement initiatives of the work force; structuring the recognition system to reward initiative and improvement; providing

for extensive education and training, including everyone in the process; and becoming personally involved in improvement activity. In sum, it means making CIP the organization's way of life.

Initial deployment of CIP into an organization requires a considerable amount of time and effort. Many changes must occur: ways of thinking, individual and group behavior, methods of accomplishing tasks, attitudes, priorities, relationships, signals, and knowledge levels. These changes will not, and indeed cannot, happen overnight. Experience indicates that 5 to 15 years may be required for an organization to reach CIP maturity, that is, before the CIP process is fully in place and considered to be the standard way of doing business.

The length of time required to reach maturity should not be perceived as a reason not to begin the transition process to CIP. Experience shows that positive results and significant returns on investment start very early in the process. CIP, when managed correctly, should essentially pay for itself even in the first year. Companies that are only 2 or 3 years into the process report return on investment of $4 or $5 for every $1 invested.

Top management in an organization is responsible for ensuring that CIP is a perpetual commitment. Every member of the organization should know with certainty that CIP is not just another fad that management will soon forget. Everyone should understand that getting on board is mandatory and that it is not possible to "wait until this CIP thing blows over." The responsibility for knowing what is going on and for providing the leadership to shape and guide the change process cannot be delegated. Each manager and each individual must recognize a personal role and responsibility and must be given a personal, intrinsic incentive in the CIP effort.

An organization that is perpetually committed will have the following elements:

- A clearly documented perpetual commitment to the improvement process that is visible throughout the organization
- Improvement-promoting signals clearly manifested in everything that management does; in meetings, speeches, communications, public relations, decisions, reward and recognition systems, and interpersonal relationships

- A process by which all new employees are educated in improvement process fundamentals as part of their standard orientation
- A strategy for assuring that the improvement process is made as immune as possible from the changing parade of personalities and short-term crises that will continuously stir the management ranks.

CHAPTER 4

PRACTICES

Practices are broad activities that reflect the organization's actions to use its principles in conducting its business. They reinforce CIP behavior through systematic and continuous exercise and produce the infrastructure and the signals that support the improvement process. Practices are customary and routine. Some practices may affect every person in an organization, while others may be targeted at a particular area or function of the business. Certain practices must be implemented early and are crucial to the process of cultural change, while others may not apply to every type of business or situation. Practices, like principles, should be clearly documented and advocated, consistently applied, and used to evaluate the level of commitment to stated principles.

Fundamentally, the CIP practices are just good management. They are being demonstrated, through applications both in the United States and abroad, to be among the best available management technologies for achieving continuous improvement and assuring competitive position and survival.

CIP practices can be grouped according to the primary principles they support. Those principles, as described in Chapter 3, are (1) constancy of purpose, (2) commitment to quality, (3) customer focus, (4) process orientation, (5) continuous improvement, (6) system-centered management, (7) investment in knowledge, (8) teamwork, (9) conservation of human resources, (10) total involvement, and (11) perpetual commitment.

SUPPORT OF CONSTANCY OF PURPOSE

Constancy of purpose, the first of Dr. Deming's 14 points of management, provides individuals with an unswerving vision of where they are going, what is expected of them, and what they expect of themselves.[1] Management behavior that demonstrates and communicates constancy of purpose is essential for CIP success. Providing constancy of purpose is a top management responsibility that is met

[1]Deming, W. Edwards. Ibid.

through several essential management practices including planning, goal setting, policy deployment, economic implementation, efficient resource allocation, and long-term contracting.

Planning

Planning is a core practice of the CIP organization; it is not the domain of merely a select handful of "planners." As a necessary part of every person's job, it is often accomplished in a team setting and provides a disciplined and structured road map for guiding and controlling the improvement process. Planning for improvement is accomplished through a structured and methodical process that ties together the diverse activities and levels of the organization. Plans for executing and evaluating improvement activity are documented and employed. However, they are flexible and subject to continuous improvement as new information becomes available. Strategic, tactical, and project planning are integrated through the planning activities of the improvement team network.

A strategic plan flowing from the ESC establishes overall improvement goals and objectives and provides the focus for all improvement activity. Tactical planning is done in a waterfall fashion by successive levels of process-improvement teams. Planning at each level deploys and implements the strategic plan into respective functional areas. Successive levels of planning become more detailed and specific, with goals and objectives eventually translated into action. Each plan is linked to its parent plan through goals, objectives, and measures of performance. Performance is improved and goals approached through improvement projects. Each process-improvement team engages in project planning as part of the PDCA improvement cycle process.

Planning is an important and visible activity in the CIP organization. Good planning is vital at the very beginning to chart a course for CIP deployment that is "right the first time." Planning is an absolutely essential part of developing the right training program, creating the team network, implementing the performance measurement process, instituting cellular production or JIT, and managing the improvement process.

The CIP organization recognizes the value of involving everyone in the planning process. Individuals feel more commitment to achieving goals and objectives when they have a sense of ownership in the plan. The improvement in

planning skills that results from involvement in the planning process carries over to many other aspects of job accomplishment. Planning becomes a dynamic activity that is elemental in the routine improvement process.

Every process-improvement team must learn to plan and to employ planning as part of the process-improvement cycle, which is often called the Deming wheel or the PDCA cycle; it comprises four steps: plan, do, check, and act. Good planning is the cornerstone of the process. If the first step in the process cycle is not right, then none of the following steps is likely to produce success regardless of how well it is executed.

To provide the most effective planning as part of its CIP, an organization should take the following actions:

- Provide a documented planning policy
- Provide training in planning requirements, techniques, and tools
- Emphasize that good planning lies at the core of doing anything right the first time
- Make sure that all levels of management understand that anything worth doing right the first time is worth taking the time to plan
- Provide mechanisms to prevent major improvement activities from entering the "doing" phase without an adequate plan
- Take the mystery out of planning so that everyone learns how to plan and is expected to participate in team planning activity.

Goal Setting

Goal setting must be linked to the planning process by demonstrated management commitment to specific means for achieving the goals articulated in the organization's plans. One of Dr. Deming's 14 points of management is to eliminate goals or numeric quotas unless management specifically provides the means and methods for their achievement.[2] That point specifically addresses goals dictated by management to lower levels, goals that will be the basis for subsequent evaluation. In the CIP organization, however, goal setting is a team activity, and the team establishes its own targets for achievement, rather than specifically setting

[2]Deming, W. Edwards. Ibid.

targets for subordinate teams. Those who set the targets have the primary responsibility for attaining them. Subordinate activities plan and set their own goals in support of parent team objectives. Parent teams provide broad objectives, and review and evaluate the planning at subordinate levels.

As part of planning, goal setting is a dynamic and routine practice. Specific quantitative improvement goals for the organization are set annually at each level for that level's achievement as part of the strategic planning process. Those goals are translated through policy deployment into compatible improvement objectives for each process-improvement team. Through this deployment mechanism, all the improvement efforts focus on achieving a common set of top-level goals.

The nature of the goal setting and policy deployment process places a high degree of importance on quality planning and commitment at the top. The strategic plan must accurately reflect the requirements of the external customer. Those requirements are the basis for the organization's top-level goals. The selected goals and objectives must be carefully defined, complete, ambitious, and realistic. The performance measurement and reward and recognition systems must be aligned with the goals. Management's emphasis is on applying the proper process-improvement methods for achieving the goals rather than on the specific quantitative results achieved.

Setting meaningful and achievable goals and objectives to provide continuity and focus for improvement efforts is one of the most important functions of management. The goals and objectives must be clear, simple, and measurable. The top-level goals should be linked to satisfying external customers and other stakeholders. They should be stated in terms that permit them to be translated into lower level goals, objectives, and actions as they flow down into the organization through policy deployment.

Goals and objectives should provide guidance for both the long and the short term. They should be consistent over time and internally compatible with one another. Goals that are inconsistent or in conflict are often worse than no goals at all.

Goal setting at the highest level is a responsibility of the ESC. The highest level goals must, at a minimum, address improvement in quality, cost, and delivery or schedule.

To use goal setting to advance continuous improvement, an organization should take the following actions:

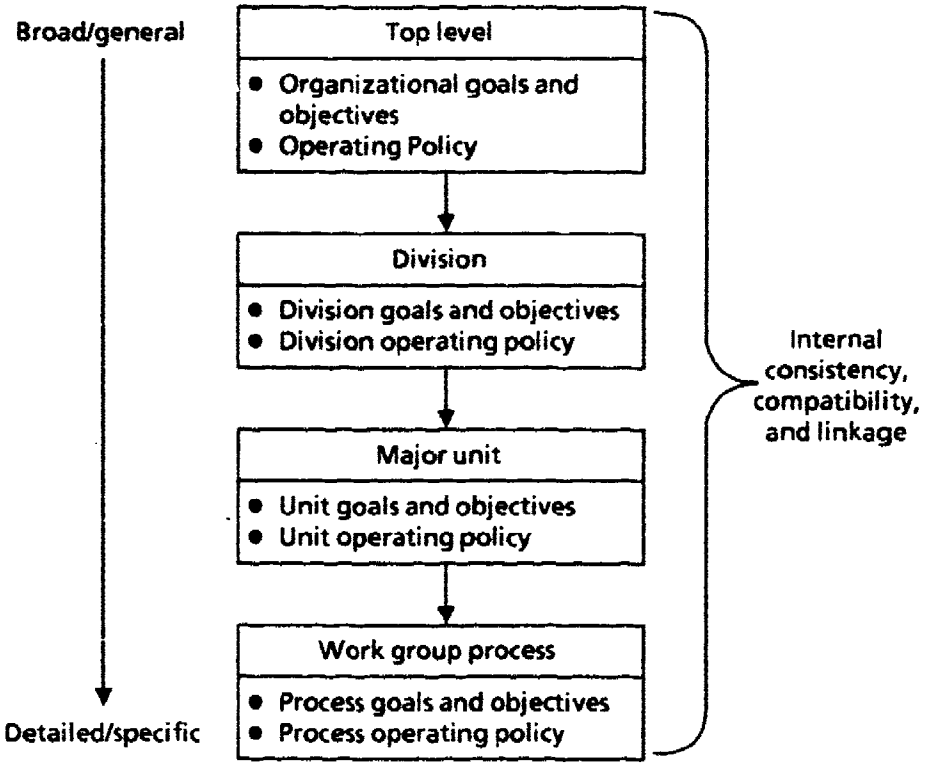
- Address the role and importance of goal setting as part of planning policy
- Provide instruction in goal-setting techniques and responsibilities for all managers and improvement teams
- Set only goals with clear links to the means and methods for their achievement
- Make sure that those who establish the goals have the primary responsibility for achieving them
- Develop goals from a clear understanding of the needs and expectations of customers
- Create meaningful indicators of performance that are unambiguous control and check points on the path for achieving the goals.

Policy Deployment

Policy deployment is the process of internalizing and communicating policies throughout the organization. It is a cascade process through which top management's objectives are translated into objectives for each activity in the organization as illustrated in Figure 4-1.

Policy deployment aligns improvement activity within the CIP organization with the overall strategic direction selected by top management. The primary vehicle for such deployment is a top-to-bottom network of interlocking process-improvement teams that translate higher level goals and strategies into team goals and actions.

An important element of policy deployment is setting priorities. The planning process may generate a number of different goals and objectives, which must then be ordered by priority such that conflicts and competition for limited resources can be resolved in favor of the greatest or most important results.



Note: Integrated goals, objectives, and policies govern each level in the organization.

FIG. 4-1. POLICY DEPLOYMENT

Policy deployment creates a link between objectives, performance measures, and improvement efforts throughout the organization. Policy deployment is achieved only when top-level policy and goals have been translated into actions with specific indicators of performance for each relevant process or job. Ultimately, all employees must interpret and understand policy and goals in the light of their own job responsibilities. The policy deployment planning activities of the process-improvement teams enable the teams and individuals to identify the criteria that indicate success in carrying out the policy. They result in a unified body of plans and a universal vocabulary for cross-functional communication.

To practice policy deployment, an organization should take the following actions:

- Document the policy deployment process as part of organizational planning policy
- Address policy deployment in improvement process training that is provided to everyone
- Develop a documented improvement policies, goals, and objectives into the organization
- Ensure that processes and projects have improvement action plans and performance measurements that are relevant to the achievement of top-level goals
- Promote individual awareness of improvement policies, goals, and objectives and facilitate an appreciation of their relationship to the individual's job.

Implementing Economically

Don't spend money first! The solution to improving quality does not involve spending more money. Rather, it consists of learning more about the processes that influence quality in order to use existing resources more effectively and manage changes intelligently.

All too often managers look to high-technology, high-cost alternatives as the means of solving problems once and for all, only to learn that they have only purchased a whole new set of problems. The sensible way to avoid that trap is to first understand the organization and then to try to improve systems using only existing resources. By applying existing resources and the improvement process to the current system, great improvements may be made. Only after that is done will the high-technology, high-cost solutions be of value.

Low-cost solutions may often be the best ones. Suggestion systems should emphasize and highly value ideas that can generate improvement with a minimal investment. The net return on investment from many small, low-cost savings of seconds or pennies can be far greater than from a few big investment actions that save days or thousands of dollars. Of course, both types of improvements are desirable and both must be implemented when appropriate and sensible and encouraged, recognized, and rewarded.

To practice economic implementation, an organization must take the following actions:

- Develop clear guidelines for simplifying and improving existing processes using the resources already available before attempting any major high-cost, high-technology solutions
- Provide training on the techniques and tools for process simplification and improvement and on the importance and implications of economic implementation
- Evaluate proposals for high-cost solutions based on hard evidence that the target processes have been improved to their full potential and that economic solutions have been fully exploited
- Ensure that process and project improvement action planning addresses a full range of economic implementation options
- Promote awareness of the individual's role in suggesting economic improvement ideas by responding rapidly and affirmatively to suggestions for simple, low-cost improvements.

Allocating Resources Efficiently

The CIP organization seeks to allocate resources most efficiently. The initial training of process-improvement teams provides clear messages about the importance of mastering existing process technologies before attempting to use new technologies or apply radical solutions. Teams are instructed in how to make efficient and effective use of team resources and shown how early, low-cost improvements can be used to leverage subsequent higher cost changes. Early improvement efforts concentrate on human solutions – improving work efficiency, eliminating waste, reducing mistakes and defects, improving safety, reducing inventory, avoiding breakdowns, and shortening process time.

Process-improvement teams are directed to aim their initial improvement projects at making changes that require little or no new capital investments. Only after all reasonable low-investment solutions are exhausted are the teams permitted to aim at moderate-investment options such as buying new tools and equipment, adding process mechanization or automation, or employing similar technical solutions. Such an approach ensures that, after the low- and moderate-investment ideas for improvement have been exhausted, the team is sufficiently knowledgeable and the process sufficiently streamlined to properly consider and effectively apply

innovative technologies and high-cost solutions. Such high-cost solutions may often be found unnecessary or inappropriate once the low-resource solutions have been implemented.

Savings generated from the low- and moderate-cost improvements should not be immediately recaptured or removed from the budgets of the improving organizations but rather should be directed toward making further improvements possible. Within reason, managers should be given the authority and responsibility to redirect savings toward additional improvement targets, generally within the same team or process area where the initial savings are realized. This approach will provide far greater incentive to improve than the expectation of a budget cut as reward for improvement.

Efficient resource allocation also applies to the distribution of personnel resources. All too often managers perceive a strong incentive to "build empires." A manager's pay and responsibility are frequently equated with the size of his/her budget or the number of people supervised. Quite to the contrary, managers should be given incentives to accomplish their missions with as few people as possible. The organization should prefer generalization to specialization and should seek to develop a minimal number of job classifications and maintain a lean organization structure. A manager's status should relate to how well his/her mission is accomplished, including how efficiently he/she uses resources.

While the efficient use of resources presupposes a reduction in the manpower required to accomplish a task, that reduction must not become a source of fear for the work force. As a matter of policy, employees should be reassured that, as their improvements reduce the number of people required in a given area, layoffs will not be the result. It must be clear at the outset that displaced persons will be retrained and reassigned to equal or better positions. Workers should be assured that greater efficiency will open up new opportunities rather than create risk. Any reduction in force should come from natural attrition, voluntary retirements, or a similar mechanism. For example, Hewlett Packard has a corporate policy that employees whose jobs are eliminated through improvement efforts will not be discharged. Instead, those employees will be relocated in the corporation or will be retrained to perform different jobs. An employee whose job is no longer required as a result of his/her own improvement efforts is effectively promoted to a new position.

Reductions in force are generally not required as a result of continuous improvement efforts because, when properly managed, continuous improvement generates new customers, increased market share, new products, and more employment. However, a company that is driven to continuous improvement because of serious financial difficulties may need to cut back on its work force. This cutback must be done with great care and skill because, if it is mismanaged, it can destroy the cooperation required between management and labor and derail any chance for effective continuous improvement. If layoffs are inevitable, they should be clearly linked to the organization's serious economic problems and not to its improvement efforts. Some financially sound organizations have been known to cut their work force simply to increase stockholder earnings. Organizations that would so blatantly injure one customer, its work force, to benefit another customer, its stockholders, have great difficulty managing an improvement process.

Because the issue of personal security is pivotal in facilitating more efficient resource employment, management must give it considerable attention. The improvement strategy must address how to retrain and reassign personnel as the nature and content of work changes through the improvement process. While improvement should generate new business and help the organization grow by making space for workers displaced by greater process efficiencies, such growth may not be synchronized with the availability of the displaced labor. The organization must be willing and prepared to absorb and constructively employ displaced personnel during a transition period. Again, any unavoidable reduction in the work force should be done through attrition or other nonthreatening means.

To practice efficient resource allocation, an organization should take the following actions:

- Document a policy on the efficient allocation of resources that provides strong incentives to employ low-resource solutions first, reinvest savings in additional improvement, and reduce the size of "empires"
- Train the work force on the efficient use of resources and make available the techniques and tools to facilitate the rapid application of the knowledge gained
- Provide positive incentives to managers to use resources efficiently and to reduce their budget and personnel requirements

- Publicize success stories and reward managers who demonstrate how to accomplish more with less
- Ensure that the actions taken to efficiently employ resources do not become threats to the work force.

Long-Term Contracting

Long-term contracting goes hand-in-hand with the practice of vendor base reduction discussed later in this chapter.[3] Properly used, long-term contracts can play an important role in providing incentives to vendors to reduce prices, pursue improvements, make a commitment to quality, and assure timely deliveries. The stability provided through long-term contracts permits better planning and encourages better communication between the buyer and the seller (or vendor). Vendors with long-term relationships are generally more inclined to invest in process and quality improvements with long horizons because they have a higher probability of recovering their costs. Long-term contracting with fewer vendors also reduces buyer-related costs by decreasing the size requirements for the buyer's contract administration staff, thus simplifying accounting, collections, and administrative workloads.

Long-term contracts must not be sought arbitrarily but must flow from careful evaluation of each vendor's performance and capability. While past and current performance must play an important role in the selection process, so too must the vendor's desire and capability to produce future continuous improvement as indicated by management processes, infrastructure, and technology. Therefore, awarding long-term contracts must be approached logically and cautiously and be grounded in deliberate and careful evaluation and screening of current and potential vendors. Such contracting should be conducted within the framework of a coherent contracting strategy and not through a piecemeal contract-by-contract approach.

Once the best and most capable vendors have been identified, they can be invited and encouraged to participate actively in joint improvement activities. Those activities, if undertaken with existing vendors before awarding long-term contracts, can serve to build and test the desired CIP working relationships and help to validate the viability of a long-term relationship. For example, working with

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[3]See subsection entitled "Reducing the Vendor Base," page 4-76, in the section on "Support of Continuous Improvement."

several vendors to develop a JIT supply capability will show an organization which vendors are willing to improve their own processes to provide the responsiveness needed in a JIT environment. Vendors unable or unwilling to aggressively pursue their own improvement efforts would not be viable candidates for long-term contracts because they do not share the same philosophic vision as the CIP organization and because without a long-term improvement philosophy, the vendor may not survive long enough to complete a long-term contract.

Increased communication between the buyer and the vendor is a cornerstone of a long-term relationship. Clear understanding is sought regarding expectations and relationships on both sides of the table. Both parties must see the long-term contract as a win-win proposition. Continuous improvement must be recognized as part of the long-term contract for both parties, and each should cooperatively seek and expect quality growth, schedule-delivery improvement, and cost reduction over the course of the contract term. To achieve these objectives, joint teams and problem-solving activities should be established to facilitate shared process improvements in much the same manner as each organization does for its own internal processes.

To use long-term contracts, an organization should take the following actions:

- Develop a means for evaluating and selecting the best vendors for long-term contracts based on price, demonstrated performance, and demonstrated capability to generate continuous improvement
- Foster teamwork, trust, and fairness in all transactions with preferred suppliers
- Build a close working relationship with preferred suppliers to support the mutual development of CIP practices
- Establish goals for accepting no defective products and attaining levels of supplier process control that preclude the need for incoming inspection
- Seek to develop suppliers capable of fully supporting JIT delivery and production.

SUPPORT OF TEAMWORK

Teamwork is essential to the success of the CIP culture because every member of the CIP organization ultimately becomes involved in some form of team activity. Teamwork is promoted within traditional functional areas and across functional boundaries to improve defined processes and address problems. It begins with top

management, where it is typically manifest in an ESC that shapes and leads the CIP cultural deployment process. Teamwork is promoted throughout the organization by the creation of process-oriented improvement teams. Steering committee members lead next lower echelon improvement teams in translating and implementing the top-level goals, objectives, and strategy into planned actions. Structured team activity continues to flow downward as subsequent improvement team structures are sequentially created around processes down through the organizational infrastructure. The practices that support the promotion of teamwork include team building, improvement team "seeding," and cross-functional integration.

Team Building

Team activity is a principal source of process improvement. The CIP organization builds a network of process-improvement teams that start from the ESC team and grow downward into the organization like roots. Each team, irrespective of its level, has essentially the same characteristics.

Every team is responsible for a process or multiple processes, either as a natural work group or as a cross-functional group. Team composition is generally determined by the next higher (parent) team's process definition. Team activities include, in order, group training, process analysis and documentation, customer requirements assessment, measurement system development, process stabilization using *Standardize-Do-Check-Act* (SDCA) techniques, and process improvement using PDCA.

Team building can follow a variety of routes. The desired route is to create process-improvement teams sequentially from the top down, as shown in Figure 4-2, with each team sequentially defining its own process and engaging in its own improvement activity before starting and training subordinate teams at the next level to address and improve identified subprocesses.

More often than not, process-improvement teams are actually natural work groups, existing organizational entities that have begun to function as teams. Every process-improvement team is similar in purpose, structure, and activity and is linked vertically both above to a parent and below to offspring teams. An improvement team is also horizontally linked to the processes that feed it inputs and those that receive its outputs. Each process-improvement team owns its process and is responsible for generating process improvements. The process-improvement team

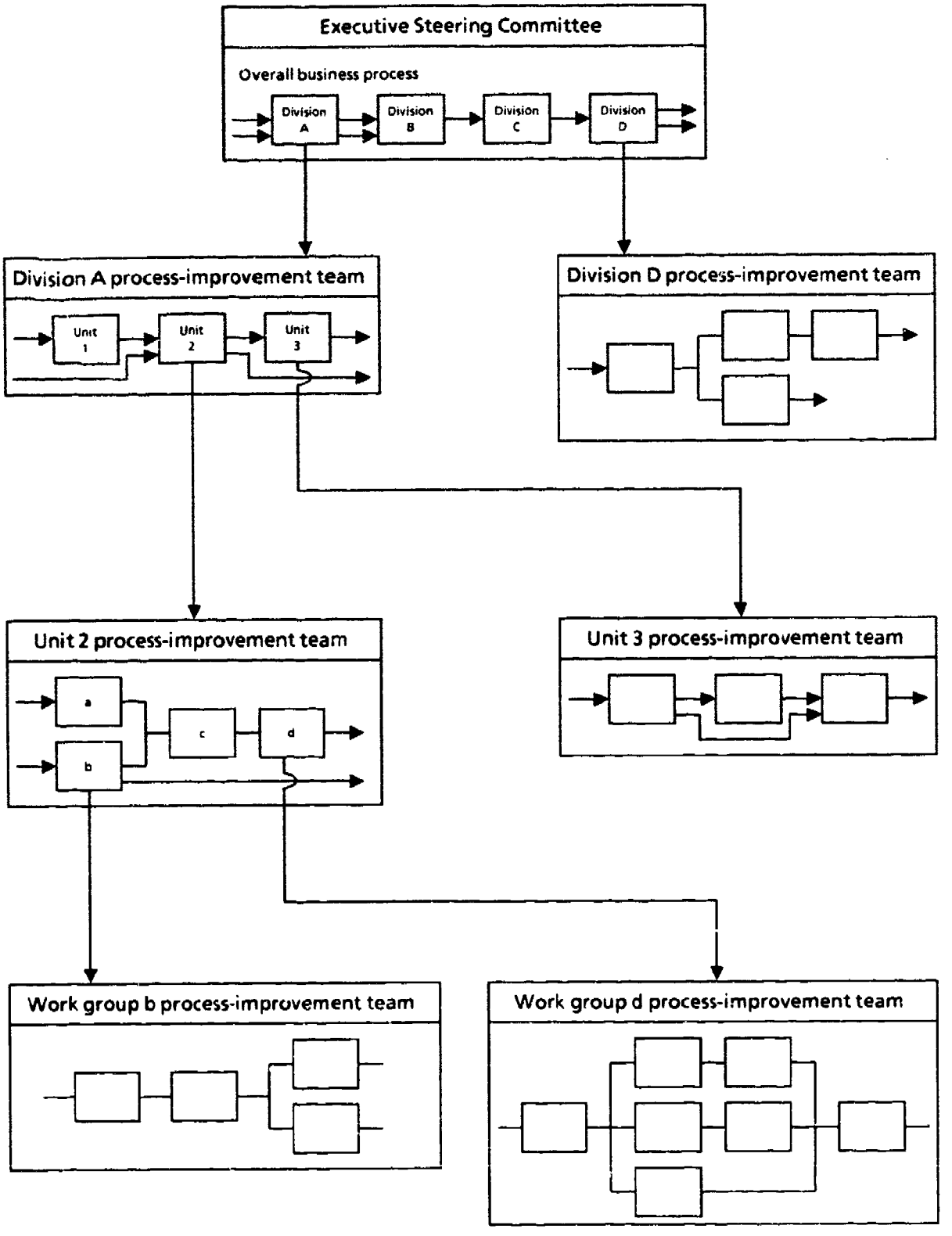

FIG. 4-2. TOP-DOWN TEAM BUILDING

comprises individuals who work in or have job responsibilities directly linked to the process. The process-improvement team leader is chosen from the team's ranks and is supported by outside facilitators, the parent team, related teams on the same level, and its subordinate teams.

Process-improvement teams are generally initiated, and to a significant degree trained, in CIP principles and practices by their parent team. Every process-improvement team meets regularly, engages in structured process-improvement activity, creates and maintains its own process performance measurement system, and communicates the results of its improvement efforts through presentations to the parent and other concerned teams. The parent teams and facilitation staff have a responsibility for nurturing offspring teams to assure that they survive and thrive.

Organizations often need to attack pressing problems quickly and are forced to find alternative approaches to the linear or waterfall creation of improvement teams. However, if a problem process resides several layers down in the organization, management should resist the impulse to bypass the management chain between the top and the target process. Such bypassing has resulted in the failure of many improvement team efforts because of lack of support or outright obstruction from middle managers.

One popular alternative, illustrated in Figure 4-3, is to create a Quality Management Board (QMB) to facilitate the attack on the problem process and process-action teams to implement the specific actions required to produces the changes needed for improvement. Process-action teams and QMBs are used to focus on specific high-priority, high-payback problem areas identified by the ESC and targeted for improvement action. A QMB functions as a parent team for the entire targeted problem process and coordinates the efforts of the process-action teams that may be created to implement process-improvement actions.

The QMB typically comprises at least three levels of management from the direct vertical line between the problem process area and the ESC and includes representation of the various functions that are closely linked to the target process. This multilevel participation is essential to avoid bypassing critical layers of management. The QMB is trained as a group in the principles and techniques of continuous improvement, engages in studying and defining its owned process, and develops a plan of attack before starting its offspring process-action teams. The

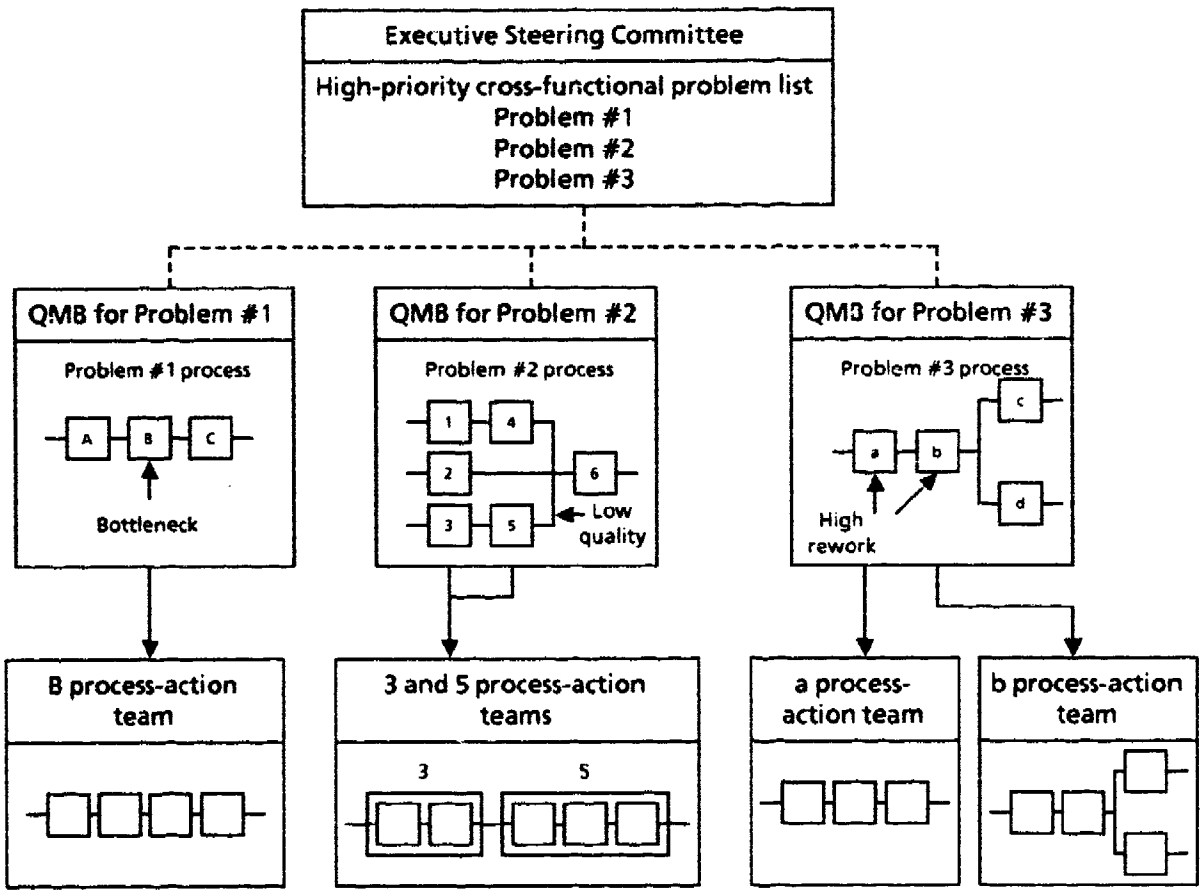

FIG. 4-3. QUALITY MANAGEMENT BOARDS AND PROCESS ACTION TEAMS

QMB functions as a standard parent team to provide guidance, goals and objectives, oversight, and facilitation to the process-action teams created to implement the plan to improve its subprocesses.

The process-action team differs from the typical process-improvement team in two important ways. First, its membership does not necessarily include all the members of the natural work group associated with the process but rather may be comprised of a mix of experts and other participants selected specifically to get quick results. Second, the process-action team is not necessarily established as a permanent improvement team with clear and natural ownership of the target process. Therefore, it may disband once the targeted problem is resolved.

Creation of QMBs and process-action teams is an excellent way to obtain fast results on chronic problem processes but should not be viewed as a substitute for the

creation of permanent process-improvement teams with real process ownership. In the long run the only way to obtain total involvement of the entire work force is to train everyone and engage everyone in the improvement process through participation in team activity with their process co-owners.

To practice team building, an organization should take the following actions:

- Document policy on the creation of permanent process-improvement teams that have true process ownership
- Provide team training specifically oriented toward building teamwork and team cohesiveness
- Orient reward and recognition to reinforce positive team behavior
- Ensure that teams are not created in isolation but with viable management support structures to provide essential guidance, oversight, and facilitation
- Seek to create teams to work on improvement for all processes and to involve everyone in process-improvement team activity.

Seeding Improvement Teams

Improvement team seeding is another means for creating process-improvement teams; however, it functions more like a blitzkrieg – a swift and concerted effort – than a waterfall. Seeding enables management to bring the improvement process to bear early on critical problem areas deep within the organization without waiting for the team deployment process to cascade layer by layer through the entire management structure. It is the deliberate, quick creation of teams deep in the organization far in advance of the normal team-building process.

As was the case in the creation of QMBs and process-action teams, top management identifies and targets major problem processes and expedites process-improvement action in those areas. Seeding is accomplished by driving a path, or branch, deep into the organization along the direct management reporting line to the problem area. Every manager along this path is considered a de facto member of a single parent team. The managers and supervisors along this vertical line are trained simultaneously as a group and accept collective responsibility for nurturing and supporting their offspring improvement teams. Major differences exist between this parent team and the typical parent improvement teams. The parent team created by the blitzkrieg approach is not itself a process-improvement team and

therefore does not engage in its own process definition and improvement activities. The blitzkrieg parent team is basically a facilitating and support team.

Training all the managers along the vertical path in CIP principles and practices is aimed at building an informed channel of communication between the actual improvement teams and top management. Establishing the entire path as a single team helps preclude any single manager in the chain from intentionally or unintentionally strangling the process-improvement team's improvement initiative. The process-improvement team looks to the parent improvement support team for assistance in removing roadblocks and eliminating bottlenecks. Since the entire chain of command is represented on the parent team, facilitating management action is greatly expedited and the attack on the problem area accelerated.

Collectively training all the managers along the vertical blitzkrieg line leading directly to the known process problem areas is also designed to assure that consistent and properly aligned management signals flow down to the improvement teams. The management team must exercise special care not to overly control or dictate approaches for improvement to its offspring process-improvement teams for two important reasons. First, the parent team members have not directly engaged in process definition and improvement activity and are likely to underestimate the difficulty involved; second, the team members represent levels of management several tiers removed from the process-improvement team and even mild suggestions may be treated as orders and executed against the better judgment of the improvement team members.

An alternate approach – one that carries substantial risks – is to bypass the vertical management chain and create natural work group process-improvement teams, like islands, in the problem areas. Organizations that have used this approach experience high improvement team failure rates but realize occasional successes because of the leaders that sometimes come from the improvement teams. The island team concept, however, will usually realize some improvement because attention is being given, even for a short time, to areas where none was previously given.

Top management still has an obligation to provide CIP training to the island teams and to provide facilitation support. Top management may need to establish a special reporting relationship directly between the improvement team and the top to

remove roadblocks and to shield the team from the negative signals that might flow from untrained middle managers. One of the major risks of this approach is alienating the middle managers who feel excluded or who fear they are losing responsibility and control.

The island-building approach should be avoided whenever possible, but if it is used, the organization should plan for bridge-building as quickly and effectively as possible. Bypassed middle managers should be kept informed about the improvement island efforts and scheduled for CIP training at the earliest possible date. The organization should make it clear to bypassed middle managers that CIP training and the restoration of normal reporting relationships through the existing management chain is a top management objective.

To practice team seeding, an organization should take the following actions:

- Document policy that team seeding is an interim approach to obtain rapid action in chronic problem areas.
- Provide training in CIP principles, practices, and techniques to the complete management chain that owns the target process or assure direct access to top management through special reporting relationships.
- Give high visibility to seeded teams and clear, fast, and certain reward and recognition for desired behavior and achievements. The work force will be watching!
- Make an extra effort to assure the success of seeded teams since they will have high visibility and be precedent setting in their functional area.
- Try to target areas for seeding and improvement action that have high probability of success as well as significant payback potential.

Integrating Functions and Cross-Functional Teaming

Many large processes require the contribution and involvement of numerous diverse functional groups. These multifunction processes are often ill-defined, with ubiquitous communication problems and territorial issues that lead to shunned responsibilities, role conflicts, and finger pointing. Such process-mediated relationships may be very complex and confusing, resulting in low quality, high cost, and missed contractual deadlines. Cross-functional integration is intended to improve communication and reduce the complexity and confusion inherent in multifunction processes. Cross-functional team building is also employed to bring

process improvement methods to bear on such processes. Cross-functional team formation cuts across the hierarchical organization reporting structure to create new horizontal channels of communication as shown in Figure 4-4.

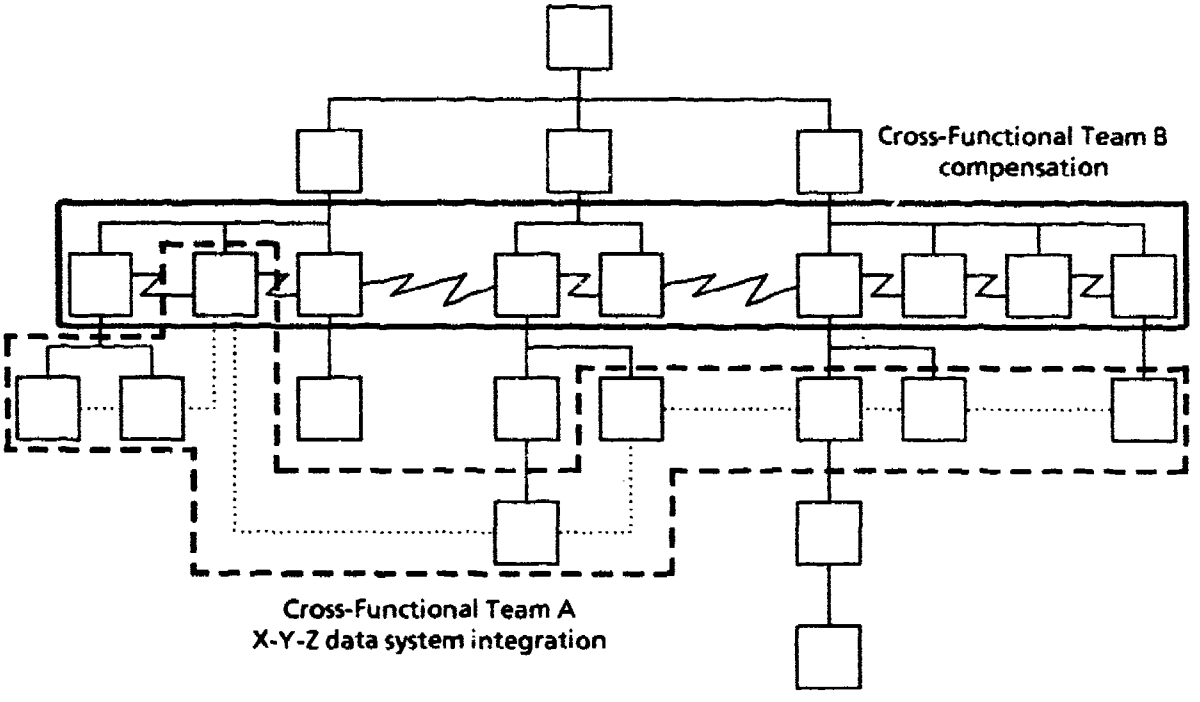

FIG. 4-4. CROSS-FUNCTIONAL TEAM/COMMUNICATION

Two classic types of multifunction processes are sequential processes and concurrent processes. An example of a classic sequential process is product development. That process involves functional groups such as market research, product planning, design engineering, manufacturing, and marketing as illustrated in Figure 4-5.

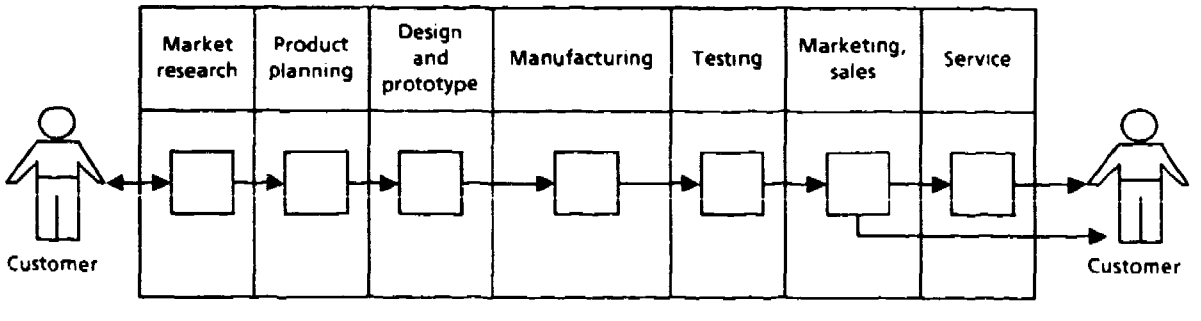

FIG. 4-5. SEQUENTIAL MULTIFUNCTION PROCESS

The product development process is notorious for its lack of communication between the functional disciplines along the development path. Each function along the line has earned a reputation for tossing its product over the wall to the next function. Manufacturing problems are frequently built in to products by design engineering decisions. Likewise, marketing problems are often built in by manufacturing decisions. The solutions to such problems lie in better communications, more teamwork, and involvement in the early design decisions by every function involved in, or affected by, the process. Techniques such as concurrent engineering, cradle-to-grave product ownership by fully integrated development teams, physical integration of office space to collocate individuals from diverse disciplines, and quality deployment all serve to produce cross-functional integration in sequential processes.

Concurrent processes, on the other hand, have a different set of problems and solutions. A concurrent process is simultaneously used by, or affects all, concerned functions. The interrelationships among functions may be subtle and the need for cross-functional teaming not as readily apparent, but like the sequential process, the concurrent process may involve many different functions and be equally complex and confusing. Examples of concurrent processes might include communication, general support, compensation, evaluation, and similar processes. Consider a company-wide communication process that employs a computer network upon which every functional department is dependent such as that illustrated in Figure 4-6.

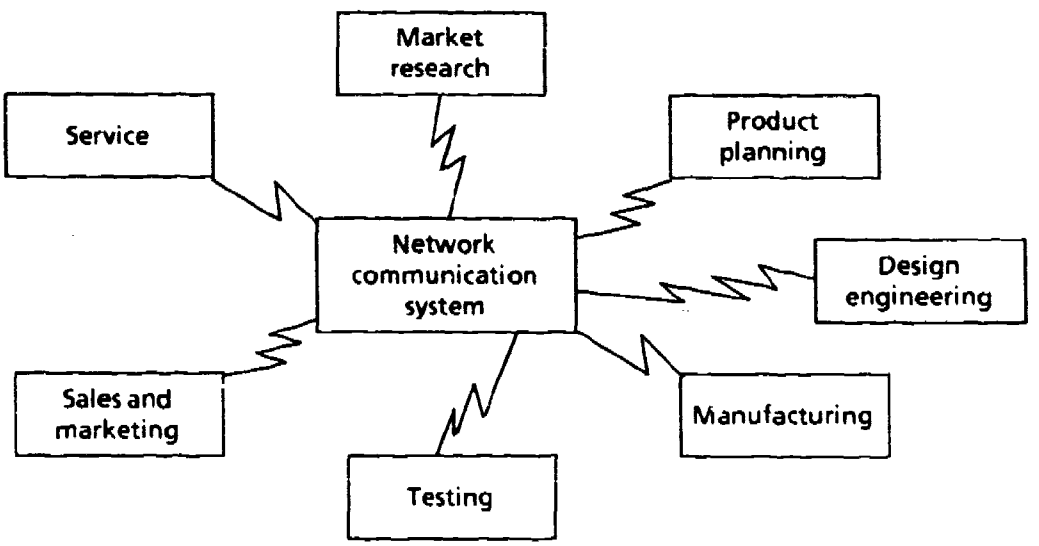

FIG. 4-6. CONCURRENT MULTIFUNCTION PROCESS

The system must be capable of accommodating the diverse requirements of all the various functional users. Any attempt to improve the system for one group may degrade a necessary feature for another group. The optimum systems cannot possibly be defined by any individual user or by the "experts" in central data processing. The optimum system and its improvement process are best defined by a cross-functional team that ensures that requirements of all affected users are given due weight and consideration in both initial design and subsequent improvement. Clearly, compromise is often necessary to achieve consensus, but the teamwork involved enriches communication and creates shared ownership in concurrent processes.

Problems may arise in sequential and concurrent processes that affect only one function but have root causes in a different function. Such problems often lead to interdepartmental conflicts, finger pointing, and poor morale. A means must be available to resolve these issues; pushing them up the chain of command, the most often used mechanism, many times leaves the issues unresolved or produces results unsatisfactory to both parties. Creating working level cross-functional teams to take ownership of shared processes and to seek mutual issue resolution is an effective alternative to pushing issues up the chain of command.

CIP management seeks to identify processes with cross-functional relationships and to integrate activities and decision making in ways that will prevent problems or provide early warning of them. The cross-functional teams address issues, solve problems, improve dialogue, and break down barriers across functional boundaries. Such teams may be permanent or temporary depending on their purpose. Teams assembled to address a single multifunctional issue may dissolve as soon as the issue has been resolved; teams created to break down barriers and improve communication along the product development path from market research through design, production, and marketing should be structured for permanence. In conjunction with cross-functional teams, the organization may also collocate related functions, employ cross training, and cross-functional exchanges of personnel, as discussed below, to achieve greater integration.

Collocation is used to break down the barriers between groups. The strategy of collocation is to create multidisciplinary groups comprising people of different functional disciplines, all working on a common project or process. That strategy departs from the traditional approach of grouping individuals of a given discipline in

a single department and location. It also differs from most project team arrangements in that communication requirements, physical proximity, and work space design are key considerations in the collocation decisions. Careful attention is given to placing individuals with the greatest need for regular dialogue as close to each other as possible. To do so entails analyzing the process and giving particular attention to communication patterns and information flow. Collocation should be approached with the same logic and precision applied to determine the optimal configuration of people as that applied to determine the optimal configuration of equipment using group technology and cellular processing. One objective is to maximize flow efficiency, feedback effectiveness, and process control.

Cross training is a procedure for providing individuals with multiple skills and broader knowledge about the various jobs related to their processes. Cross-trained individuals can move more freely among areas and tasks and help make the work force more flexible. They can rotate job assignments, thus helping to relieve boredom, expanding total process understanding, and increasing teamwork and process integration. Broader process knowledge increases the shared vocabulary for improved communication; it opens new channels for creative thought about potential improvement by broadening the exposure and experience of individuals; and it creates greater flexibility in the employment of the work force as priorities and workloads shift.

For example, on a functionally arranged manufacturing floor, each individual may be trained to operate only one type of equipment. However, a cellular manufacturing process lends itself to cross training such that each individual is capable of operating any machine in the cell. Such cross training reduces dependence on specific individuals and gives the cell the potential to operate with fewer people than required in a functionally grouped setting.

Cross training, like collocation, should be based on a deliberate strategy. People should be cross trained in areas that relate to their existing skills. The cross-training objective should be to expand the range of skills and make individuals into generalists rather than simply moving them from one specialty to another. A key consideration should be to enable the individual to make use of old skills and new skills in a posttraining assignment.

Cross-functional exchanges are a form of on-the-job cross training. Persons from one functional area are assigned to work for a period in a related functional area where they can learn about the problems, issues, and needs of the associated area and can better understand other functions.

Cross-functional exchanges should be carefully designed to assure that individuals are exposed to the areas and issues most related to their parent functional areas. If an individual is assigned to tasks that fail to provide relevant insights that can be translated into improved products or services upon return to his parent function, the exchange will be largely wasted.

To practice functional integration and cross-functional teaming, an organization should take the following actions:

- With respect to cross-functional integration, document a policy to address cross-functional teaming, collocation, and cross training
- Encourage and provide support for cross training and cross-functional exchanges of personnel
- Recognize and reward the acquisition of new skills and make new learning opportunities readily available to all employees
- Facilitate the broad application of skills by designing a work environment in which generalists rather than specialists are developed.

SUPPORT OF INVESTMENT IN KNOWLEDGE

Profound knowledge is the foundation of all deliberate improvement. Both the individual and the organization are responsible for expansion of knowledge. Investment in knowledge is aimed at maximizing human potential. Planned improvement requires understanding why things are done and how they are done and experimenting to discover better ways of doing them. In the workplace, every employee should be challenged to grow in value to the organization and in self-worth. An organization that practices CIP contributes to that growth by providing training, facilitating knowledge-building processes, enhancing communication system effectiveness, providing access to experts and experienced individuals, and building awareness of both the external and internal factors that influence mission accomplishment.

Training

Training is of the utmost importance in the CIP organization. Training courses are prepared for, made available to, and required for all employees. The courses cover a broad range of topics from management practices and group dynamics to engineering and statistical methods to specific technical disciplines endemic to the organization's work. Training is an integral part of the CIP deployment process, and both individuals and groups are trained just in time to apply the information in their improvement process activities.

Training is recognized as an investment in people. The value added through training is realized in enhanced performance, greater flexibility, and new ideas for process improvements. The potential of continuous improvement cannot be realized without proper training to continuously expand the employee's knowledge base and intellectual horizons.

Training is made available in a variety of forums ranging from university courses to special seminars and from internal classroom instruction to on-the-job training. Extensive on-the-job training is characteristic of most improving organizations. That training is so important that it is one of Deming's famous 14 points.[4] On-the-job training increases the probability that the training is in fact just in time.

Many improving organizations employ a cascade approach to on-the-job training delivery. Supervisors are responsible for subordinate training for many of the principles, practices, and techniques of improvement. This approach not only requires supervisors to be fully trained first, but more important to fully appreciate and use the improvement technologies before demanding their use by subordinates.

Groups or teams that work together in a process are frequently trained together on topics of mutual concern. Such group training should be a significant part of the training process in the improving organization. It plays a major role in forming process-improvement teams. The group training setting is designed to impart information to the participants and to generate interaction leading to team cohesion and common purpose. Such group training is best configured as an ongoing series of meetings during which a smaller portion of each session is dedicated to the

[4]Deming, W. Edwards. Ibid.

presentation of new information and a larger portion is used to work on team issues and activity. In this way, the training sessions eventually evolve into regular working meetings.

Numerous sources of training materials relate to continuous improvement, but to date no single source completely addresses the broad array of improvement topics. Additionally, no generic off-the-shelf training materials adequately address the myriad details of a given organization. The improving organization will probably need to develop internally some of its own training resources in addition to using off-the-shelf material and outside expert instructors. Most improving organizations must carefully select the best and most appropriate training material on each topic from among the available resources. Most organizations will be better served by a properly tailored mixture of concepts and approaches from a variety of advocates and experts than from rigidly following the recipe of a single teacher.

Most improving organizations rely initially on outside instructors for early improvement training. The improvement strategy should seek to develop an internal training capability as quickly as possible, however. That development is particularly important in light of the knowledge that training should not be a one-time shot of information but rather an ongoing and unending part of the improvement process. Arrangements for outside expert instructors should include the training of internal facilitators and training staff personnel.

Most initial training emphasis focuses on CIP as a separate, distinct subject. Such focus is necessary in the early stages of implementation, but ultimately CIP training material must be integrated with all job-performance and technical skill courses and cease to be a unique, independent subject.

To stimulate continuous improvement through training, an organization must take the following actions:

- Document guidelines that recognize training as an important and permanent part of CIP and stresses the just-in-time delivery of training
- Provide early emphasis on developing a training strategy and provide sufficient up-front attention and resources to create a tailored training program
- Practice a cascade approach to training that involves supervisors directly in the delivery of on-the-job training to subordinates

- Employ group training that combines the delivery of new information with the immediate application of that information to group improvement activity.

Facilitation

Facilitation is an important practice for deploying the CIP culture into an organization. Facilitators, like trainers, are purveyors of knowledge. Both external and internal facilitators are used to provide education and guidance through the transition from awareness to maturity. External consultants are generally employed in the earliest phases to assist top management in understanding and becoming involved in improvement activity. Ultimately, internal full-time facilitators are essential to assist in the deployment of process-improvement teams and activities.

The facilitation staff typically reports at a high level, e.g., the ESC chairman, and is not made part of an existing function like quality assurance. It is crucial that continuous improvement facilitation not become a seed for empire building. One element of the facilitation staff's charter is to work itself out of a job as quickly as possible. Once an organization has reached maturity, the facilitation staff may no longer be needed. As long as facilitators are required, they should be viewed as extensions of top management and be equally at home anywhere in the organization's structure. This maximizes their flexibility and mobility and precludes their being relegated to stereotyping as part of a particular function or department.

Facilitation is a necessary activity in any organization that seeks to implement a CIP culture. It is particularly important during the transition period while new process-improvement teams are being formed and learning to work together to define, stabilize, and improve their processes.

During the early stages of improvement, both external and internal facilitators are generally required. The external facilitators are typically brought in at the beginning to assist in establishing high-level management commitment and initiating management team structures and activity. Other activities in which these outside consultants are often useful are designing training programs, developing internal facilitation capability, and assisting in the implementation and use of some of the more-complex techniques and tools.

Internal facilitators may be hired, but typically they are developed from current personnel. Employees may be screened for the attributes that characterize good facilitators such as intelligence, gregarious personality, tact and people skills, and high job performance. Such individuals are then educated through a combination of formal classroom training and on-the-job apprenticeship with external expert facilitators. Internal facilitators serve to coordinate and integrate the overall improvement effort. They work with teams at all levels of the organization. Their job is to observe, instruct, assist, coordinate, guide, assess, and advise rather than to direct and supervise the improvement process. The facilitator does not have to be an expert in the technical aspects of the process being improved but must be an expert in CIP. The facilitation cadre is typically a mixture of both full-time and part-time facilitators. They function as guides to help teams develop the proper process focus and appropriate team behavior. They provide advice and assistance to team leaders and managers, give informal CIP instruction, and moderate nominal-group-technique workshops.

An important role of the facilitator is that of an impartial observer. While facilitators are present during team activities, they generally do not lead them. That is the team leader's role. Constructive critiques may subsequently serve to sharpen team leadership skills. The observer role also enables the facilitators to provide objective assessments of progress and suggestions for improvements to top management.

To support CIP, an organization must take the following actions:

- Provide a well-trained and highly professional internal facilitation staff as a vital and necessary component of success
- Establish the facilitation team as an independent staff function reporting in at the highest level of management
- Provide a strong and visible mandate for the facilitation staff and make available sufficient resources and backing, as appropriate, to overcome roadblocks and resistance.

Enhancing Communication

The CIP organization employs a variety of means to improve both internal and external communication. Contact with customers and vendors is increased, and joint problem-solving teams are created where appropriate. Strong emphasis is placed on

collecting data related to product or service performance and assuring timely feedback to the design, manufacturing, and other appropriate functions.

Internal channels of communication are developed and kept open. Cross-functional teams are established; new media are created; regular meetings are scheduled; and performance data are collected, analyzed, and conspicuously displayed. Raising issues and identifying problems are encouraged and rewarded. Management behavior that constrains open and free communication is discouraged and eliminated.

The organization develops an open communication policy that is carefully crafted and widely publicized. Such a policy usually includes an open door to managers and supervisors that is not limited to the traditional "chain of command." The policy makes clear that problems are opportunities for improvement and that management actions tending to "kill the bearer of bad news" will not be tolerated. The policy not only encourages the exposure of problems, it promotes the communication of success stories and the recognition of positive ideas and results.

The roots of deliberate communication enhancement are found in a comprehensive communication strategy. The organization may employ a cross-functional team to develop the strategy and oversee the implementation of communication process improvement. The team examines the existing system and defines the major flows of information, both internal and external. Communication problems and shortfalls are identified. Specific goals and objectives with respect to improved communication are developed and means for attaining the goals defined. Specific indicators of effectiveness for the communication process are identified and made part of the performance evaluation system.

The communication enhancement strategy has both external and internal components. The external component addresses how the organization communicates with customers and vendors. Customer communication would include advertising, sales contacts, customer service, billing, product manuals, surveys, customer visits to company facilities, employee visits to customer facilities, and other forms of contact. The team should consider each of these communication modes to determine whether they are meeting the needs and expectations of both the customer and the organization.

Vendor communication would include contract negotiations, contract language, specifications, inspections, joint meetings, facility visits, account management, payment, oversight, on-site liaison, performance assessment, and all other forms of information exchange. The organization should address each of these communication modes to assure that they are compatible with building better working relationships and improving the external product and service acquisition process.

The internal component of the communication enhancement strategy addresses how the organization communicates through the management structure and with employees. Communication through the management structure must be healthy in both vertical and horizontal dimensions. The vertical modes of communication include policies, goals, objectives, instructions, directives, standard procedures, technical manuals, suggestion systems, appraisal systems, reporting systems, staff meetings, and the variety of memos, conversations, or data exchange media aimed at the vertical flow of information.

The horizontal channels of communication are generally less well developed and defined than the vertical channels. They include intergroup meetings, negotiations between internal suppliers and customers, staff newsletters, cross-functional exchanges, joint problem-solving activity, data interchange networks, quality function deployment, seminars, bulletin boards, and other means of achieving horizontal information flow. Each of the vertical and horizontal communication mechanisms needs to be considered by the team and integrated into a comprehensive communication strategy. Particular attention should be given to how well each of the communication mechanisms supports the goals of the organization and facilitates the improvement process.

The team must keep in mind that informal mechanisms for communication are as important as formal ones and that communications analyses should not be limited to the formal mechanisms. Equally important, the organization must recognize that communication has both overt and covert components. Most of the mechanisms addressed above are overt. However, some effort should be given to examining the subtle messages communicated by management behavior and organizational "body language." These covert forms of communication can frequently be more important in facilitating or blocking improvement than the formal or overt forms. If the covert

communication contradicts the official statements, management is likely to be seen as only giving lip service to improvement.

To enhance its communication, an organization must take the following actions:

- Develop communication guidelines that encourage an energetic and open flow of information both vertically and horizontally
- Promulgate a comprehensive communication-improvement strategy that addresses both the internal and the external environments
- Employ a cross-functional improvement team to examine and improve the communication processes
- Become aware of formal and informal communication mechanisms and seek to align and employ both for advancing improvement
- Address the covert forms of communication through signal analysis and education to ensure that the subtle signals are compatible with the official pronouncements about improvement.

Using External Experts

Continuous Improvement Process organizations generally rely on external experts to educate top management and facilitate high-level team activities in the early phases of CIP deployment. External experts can help provide a focal point and lend credibility to the initiative in the early stages. They have reputations and established track records that can help convince the skeptics and persuade the top management team to demonstrate its commitment through action.

Although external experts are not essential to a successful CIP effort, they can be instrumental in "jump starting" the organization and building early momentum. They may be employed to develop training programs, facilitate early team activities, train an internal facilitation staff, and tailor such tools and techniques as group technology, statistical process control, and JIT to the specific needs of the organization.

Many management consultants concentrate on specific subsets of the CIP principles, practices, techniques, and tools. Few practice the entire scope of CIP culture. Most organizations find that they must draw upon ideas and techniques of a

number of different outside sources before they finally assemble a complete or mature CIP.

Finding the right external experts is often a difficult trial-and-error process. The process is greatly simplified if a strong leader at the top of the organization has a clear vision of where the organization is being led. However, more often the organization is faced with a paradox: it does not know enough about improvement to choose a consultant wisely and it needs a consultant to help it become informed enough to choose wisely.

One solution to this predicament is to bring in several different consultants for one-time awareness briefings to top management. Those briefings will serve to educate the management team and simultaneously permit the ideas and concepts presented to be compared, discussed, and screened for applicability to organizational needs. Another approach is to use the ESC or other selected managers to identify initial improvement needs, review the available literature, present summarized findings, compare the various approaches, and select an initial consultant based on the best match between published approaches and identified needs. This approach requires a certain amount of training and education for those screening the available material.

A third approach is to contact similar organizations that have successfully implemented CIP for assistance or seek out the consulting groups used by those organizations. While this approach may provide some benefit from lessons learned in earlier efforts, an organization should be cautious about using consultants employed by competitors and take steps to ensure that the consultant will respect the principles of confidentiality. A respectable consultant will not divulge competitive information about one client to another. A consultant who offers to share information about a competitor's strengths and weaknesses is likely to be equally talkative about your business.

Finally, third-party organizations may be employed to perform initial assessments of an organization's improvement needs and to provide recommendations about which approaches or consultants to employ.

In using outside consultants in its continuous improvement effort, an organization must take the following actions:

- Carefully investigate the ideas and methods of a number of different consultants to determine which ones best fit the needs of the organization
- Have a plan that will move the organization toward self-sustaining CIP operation
- Build on the experience of other pioneer organizations and use proven techniques and tools rather than reinventing the wheel because "we are different."

Assessing External Factors

External assessment is a process of examining environmental factors outside the organization, generally those beyond its control but bearing on its business strategies and success. External assessment provides a framework within which top management may seek opportunities, identify risks, and plot the strategic course for the organization. The findings of the review are used to shape the strategic plan for the coming year. The review is part of the annual planning process and is instrumental in shaping the organization's goals and objectives. The review process enables the functional areas and teams to have an early, front-end input to the annual planning process as well as to participate in the flow-down of the planning process through policy deployment.

A CIP organization conducts a formal external assessment early in its cultural transition and periodically thereafter, usually once a year, to ensure an accurate, complete, and up-to-date understanding of the marketplace and other external factors essential for informed decision making and ultimate survival of the organization. The organization examines and assesses the competition, its strengths and weaknesses, position in the marketplace, products, tactics, and quality trends and directions. It monitors the constantly changing technologies across the broad spectrum of disciplines that affect the business, including management, production, and product-related technologies. Additionally, it studies the external financial conditions and, as appropriate, the political climate to understand how such factors might affect the organization. It also addresses customer preferences, attitudes, needs, expectations, and in particular, the evolving nature of consumer behavior.

While activities such as customer analysis are necessary and continuous at an appropriate informal level to ensure current awareness of customer requirements and changing conditions, the CIP organization plans and conducts its periodic formal assessments to ensure that external factors are examined fully in a structured and deliberate way and integrated into the strategic planning process as shown in Figure 4-7.

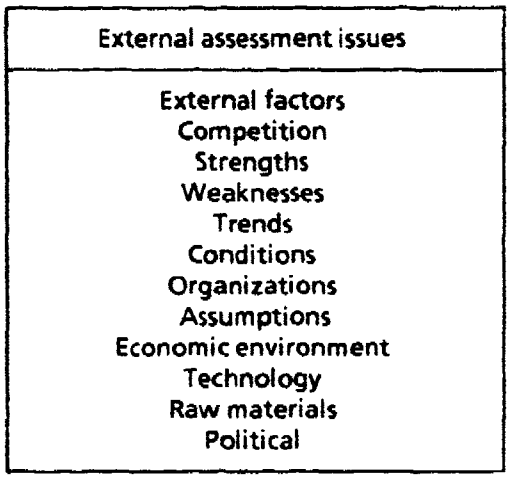

FIG. 4-7. ASSESSING EXTERNAL FACTORS

The assessment of external factors is generally conducted by the top management team charged with annual strategic planning. The team includes representatives from all key business areas and typically develops an agenda of key strategic issues and questions pertinent to the strategic planning process. It then assembles, structures, and evaluates the assessment information to highlight changes in the external environment, address the issues, and adjust the business strategy accordingly. The external assessment need not involve a huge annual information-gathering effort, but rather it may depend on routine ongoing information-gathering by the various internal functions. In conducting the formal external assessment, top management simply draws on the internally available information and supplements it with specially collected data only where necessary. Outside experts as well as internal functional managers may be called upon to give presentations to the assessment team. While the assessment may uncover issues that require some additional data collection effort, the bulk of the information

required should come from routine customer research, customer service data, marketing and sales data, research and development efforts, and similar sources.

The external assessment is unique for each organization and is dictated by the nature of the business. Each organization identifies the range of external issues that are important to its success and survival. Those issues are generally the same year after year, but their priority may be changed according to changing annual objectives. Functional groups should be given ample time to prepare and present their information to the assessment team. The assessment team should not respond to presented information in a critical way, nor should it attempt to deal with such information in isolation; rather, it should integrate the information into a broad picture of the external environment that will help to shape the business strategy for the coming year. Internal issues such as the quality of data or internal activities that may surface during presentations should be handled professionally and constructively off line and apart from the external assessment process.

In recognition of the fact that its survival depends on understanding the nature of the marketplace, identifying opportunities and risks, and planning for success, an organization must take the following actions to provide external assessment:

- Develop a means to collect and analyze information on those external factors that influence its competitiveness and survival
- Involve top management in translating the findings of external assessment into business opportunities and strategic directions
- Share management's understanding of the relevant marketplace information with the organization's entire work force.

Assessing Internal Factors

Internal assessment is part of the annual planning process of a CIP organization. It involves examining internal factors that bear on organizational goals, objectives, business strategies, and success. Findings from the assessment are used in strategic planning, and the assessment process permits internal functional areas to provide meaningful input at the front end of the annual planning process.

Internal assessments ensure that management is aware of the internal factors and issues that can influence its success and survival and understands them. The

internal assessment is focused by a predetermined top management agenda based on key internal issues shown in Figure 4-8.

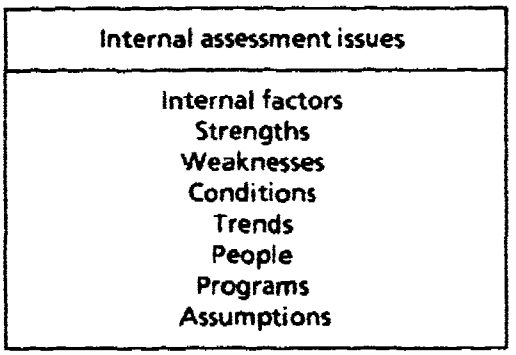

FIG. 4-8. ASSESSING INTERNAL FACTORS

The organization examines its organizational infrastructure; plant and equipment; inventories; cost structures; reporting relationships; policies and practices; attitudes; internal communications; information availability, flow, and processing; control mechanisms; reward and recognition systems; and other internal processes.

The internal assessment helps identify issues and opportunities for the organization. It helps top management shape an internal improvement strategy that supports the business strategy and strategic direction of the organization. Like the external assessment, it is a structured annual review conducted by a top-level management team of the areas considered important to maintaining corporate health. Functional areas or teams prepare information packages for the review and identify issues and priorities. Internal progress and change are evaluated against the previous year's assessment, with particular attention paid to identifying internal factors that are roadblocks to CIP.

In recognition of the fact that success and survival depend as much on understanding the internal issues and pursuing the opportunities for improvement as they do on external market factors, an organization must take the following actions to conduct an internal assessment:

- Conduct an internal assessment as part of the annual planning process to give the functional areas and teams a forum for input to the review process

- Develop a structured means to collect and analyze internal infrastructure information and translate those data into actions for improvement
- Share the internal assessment information with the employees and involve them in the improvement process.

SUPPORT OF PROCESS ORIENTATION

One of the most effective ways for an organization to improve itself is to simplify, standardize, and improve its processes. The quality of products and services is derived directly from the quality of the associated processes. Waste and defects come from defective processes; by correcting such processes, we can prevent problems and reduce the costs of non-value-added activities.

Process orientation requires a significant change in management thinking. Managers must think more in terms of process improvement and less in terms of finished products. Management actions must become more proactive and less reactive.[5] Performance measurement must be used to verify that processes are in control and operating properly, and managers, through in-depth process knowledge, must recognize and even anticipate process problems and take timely corrective action.

Simplifying Processes

Process simplification aims at eliminating those activities that do not add value to the product and streamlining those that add value. A process is more than the sum of its parts; the relationship of the parts really defines the process. A great deal of improvement can be achieved through simplification, which seeks to optimize the relationship of process steps to remove waste and to reduce the potential for defects.

Most processes have far too many steps. Over time, reorganizations, moves, quick fixes, poor design, management control techniques, and numerous other sources introduce non-value-added steps into processes. These relics often become accepted as standard procedure and are never questioned. Deliberate analysis is required to find and eliminate such waste. When long-established processes are

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[5]In contrast to *reactive*, which means *responsive to a stimulus*, *proactive* means *anticipating a stimulus* or acting in advance of need.

subjected to deliberate scrutiny, numerous unnecessary process steps are typically found.

Simplification requires questioning and rethinking the need for each process step. Simplification analysis is an important precursor of standardizing, automating, or applying a major technological upgrade to any established process. History is replete with horror stories of wasteful and defective processes being automated, "warts" and all. Many systems analysts and programmers are not qualified to question the design of an existing process but only to replicate it for computer-assisted execution. Those who own the process are generally the most qualified to simplify it.

Numerous techniques and tools are available for process simplification, and the CIP organization identifies those that are relevant to its processes and makes them available to the improvement teams. Training is provided in their proper use, and their application is part of the organizations improvement policy.

Most simplification techniques require process steps to be identified, arrayed sequentially, and differentiated according to specified criteria such as value-added, process time, or cost. Figure 4-9 illustrates an exemplary process, and Figure 4-10 shows its simple process time diagram. The process time diagram is a powerful tool for process simplification.

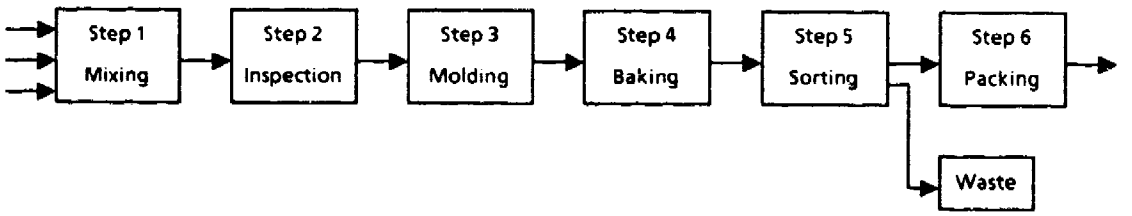


FIG. 4-9. EXEMPLARY PROCESS

In Figure 4-10, process steps are numbered sequentially and identified as value-added (at the top of the center line) and non-value-added (on the bottom of the center line). The length of each step is proportional to its processing time. The process is simplified by first eliminating the non-value-added steps to the extent possible and subsequently reducing the time required in the remaining steps through careful process redesign.

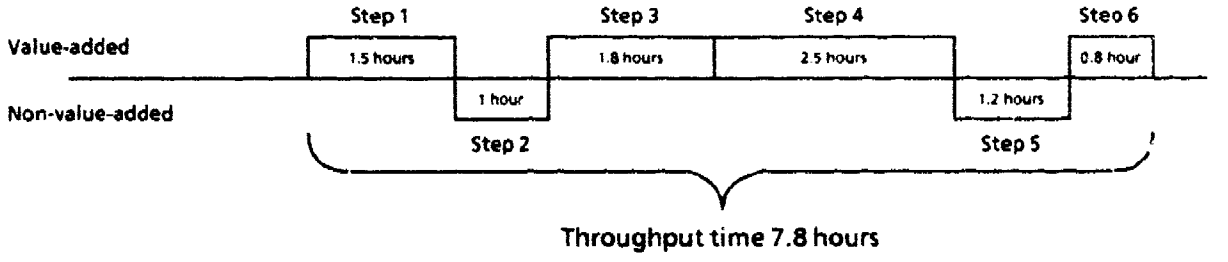


FIG. 4-10. PROCESS TIME REDUCTION DIAGRAM

The improvement teams have the primary responsibility for process simplification. However, they may require outside assistance to differentiate the value-added and non-value-added steps. Management may also have to facilitate the elimination of non-value-added steps since they will often involve "turf" or job security issues. Middle managers in particular may be threatened by the elimination of perceived "control mechanisms," many of which do not add value.

To simplify its processes, an organization must take the following actions:

- Make process simplification part of its improvement policy and require a process simplification analysis before approving major financial investments in new process technology
- Provide training in the techniques and tools of process simplification
- Make process simplification a primary responsibility of the improvement teams
- Provide facilitation and assistance to the teams in performing and executing process simplification
- Be willing to give up many non-value-added activities even though they have become part of management's "sense of control."

Standardizing Processes

Understanding and standardizing processes is essential to gaining control and systematically reducing process variation, a principal cause of defects and waste. A CIP process standard defines the process, its requirements, and associated actions. CIP process standards are dynamic; they are fixed only until improved and serve as reference points against which improvement is to be judged. They are part of process documentation and reflect current thinking about the best, easiest, safest, fastest,

least costly way of producing a defect-free product or service. A CIP process standard is not a goal, a target, or an expected rate of production. It is an instructional device, a guide, an accepted methodology, and a prescription for doing work right the first time and every time until the standard is improved.

The CIP organization seeks to standardize the way work is accomplished based on the current collective understanding of requirements, process capability, and best methods. As requirements change or process knowledge improves, the process standards change to reflect the new understanding. Process standards provide the basis for training, performing, and measuring performance. CIP process standards are not levels of performance mandated by management; rather, they are primarily the creation of the team that owns the process. They provide detailed guidance about the steps, methods, tools, and requirements for accomplishing a job, and define what "right the first time" really means.

Process standardization has three major phases: definition, maintenance, and improvement. The phases are linked, sequential, and of equal importance. While each phase addressed below is a stand-alone practice, planning for any meaningful process standardization effort must include all three phases.

Defining Standards

Defining process standards is a deliberate and disciplined effort to document and provide structure to processes and work accomplishment. Documenting process standards is integral to the larger effort of process improvement. A properly written process standard is a codification of the best way currently known to perform the process until a new standard is developed. The current standard reflects the one and only "recognized" way to do it right the first time.

Management's job is to continuously re-create the system and processes by which work is accomplished. This task is unending because new knowledge, technology, and competition continuously redefine what is possible and new customer requirements continuously redefine what is required. Since the perfect system or process can only be approached, change is essential and continuous change is a hallmark of a healthy organization.

For a worker within a system, however, constant change can appear chaotic, and the worker's desire to do his job right may seem constantly frustrated. The CIP

process standard is a mechanism that helps the worker cope with constant change by enabling him to establish and document at any given moment what constitutes an accepted definition of proper job performance. Defining a process standard requires documenting process relationships, methods, tasks, and flows as they currently exist, not as they might exist ideally. The standard is the baseline against which all improvements are made and measured. It reflects the current state of process understanding and, when properly used, can stimulate both managers and workers to seek expanded process understanding for improvement.

Management, with the help of the work force, improves the current system by continuously redefining its constituent process standards. Subordinates understand that until it is changed, a standard constitutes an agreement between subordinate and superior as to expectations for doing a job right the first time. The task of the typical worker who does not intentionally create defects or waste but only wants to do the job right is greatly simplified by a clear and accepted standard. Without such a standard to define what right means, the worker has no consistent benchmark for any work.

That process standards are typically implied but undefined is a root cause of many problems and a primary source of labor and management conflict. Without defined standards, wide variability in work performance is inevitable; without a standard, what is acceptable one instant is unacceptable the next; without a standard, each individual must form an interpretation of the "right way" to do the job and the result is overall poor performance even when everyone does his/her very best.

Continuous Improvement Process teams define process standards for complex or critical jobs. Those standards include process flowcharts such that shown in Figure 4-11, cause-and-effect diagrams such as that illustrated in Figure 4-12, task descriptions, and process standard sheets. The process flow and cause-and-effect diagrams describe the overall process and serve as both educational and analytical tools.

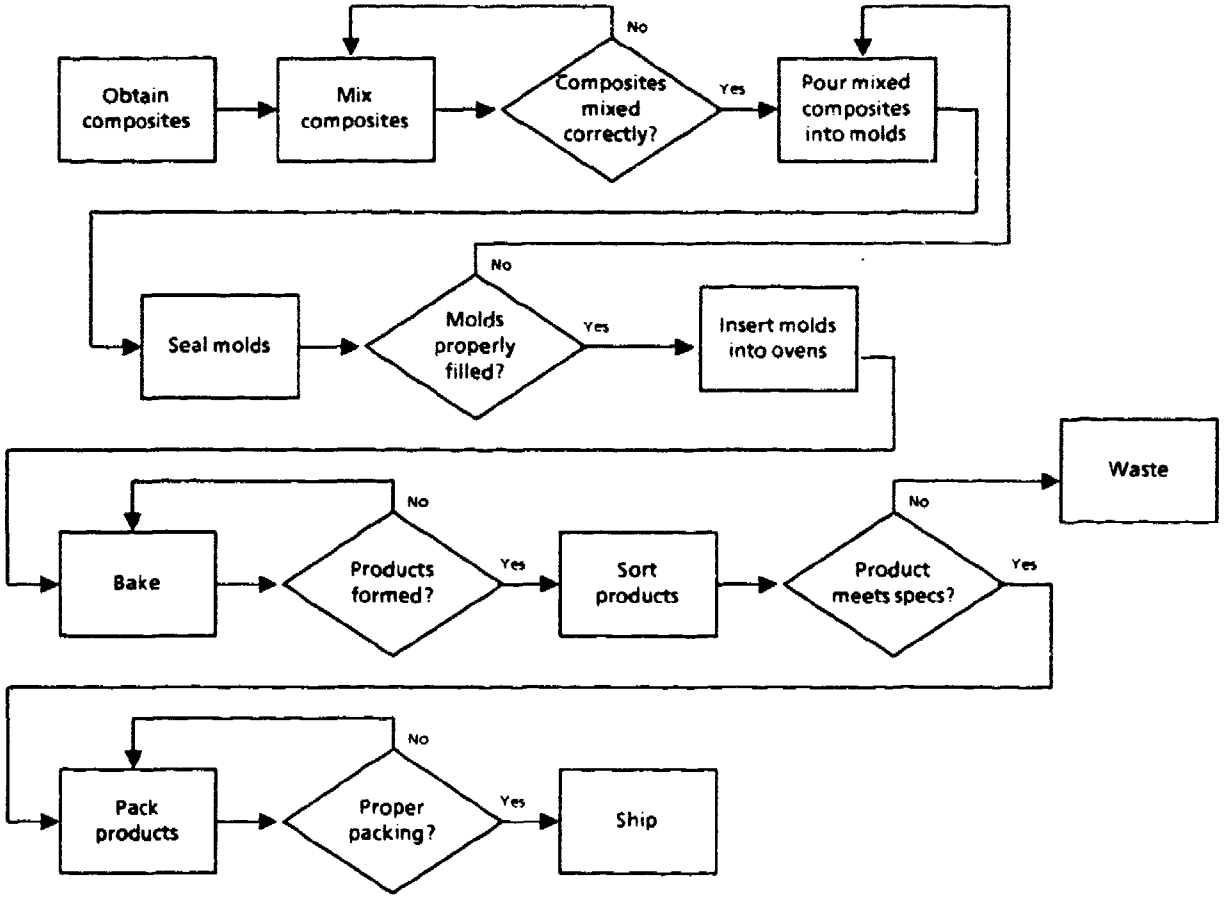


FIG. 4-11. PROCESS FLOWCHART

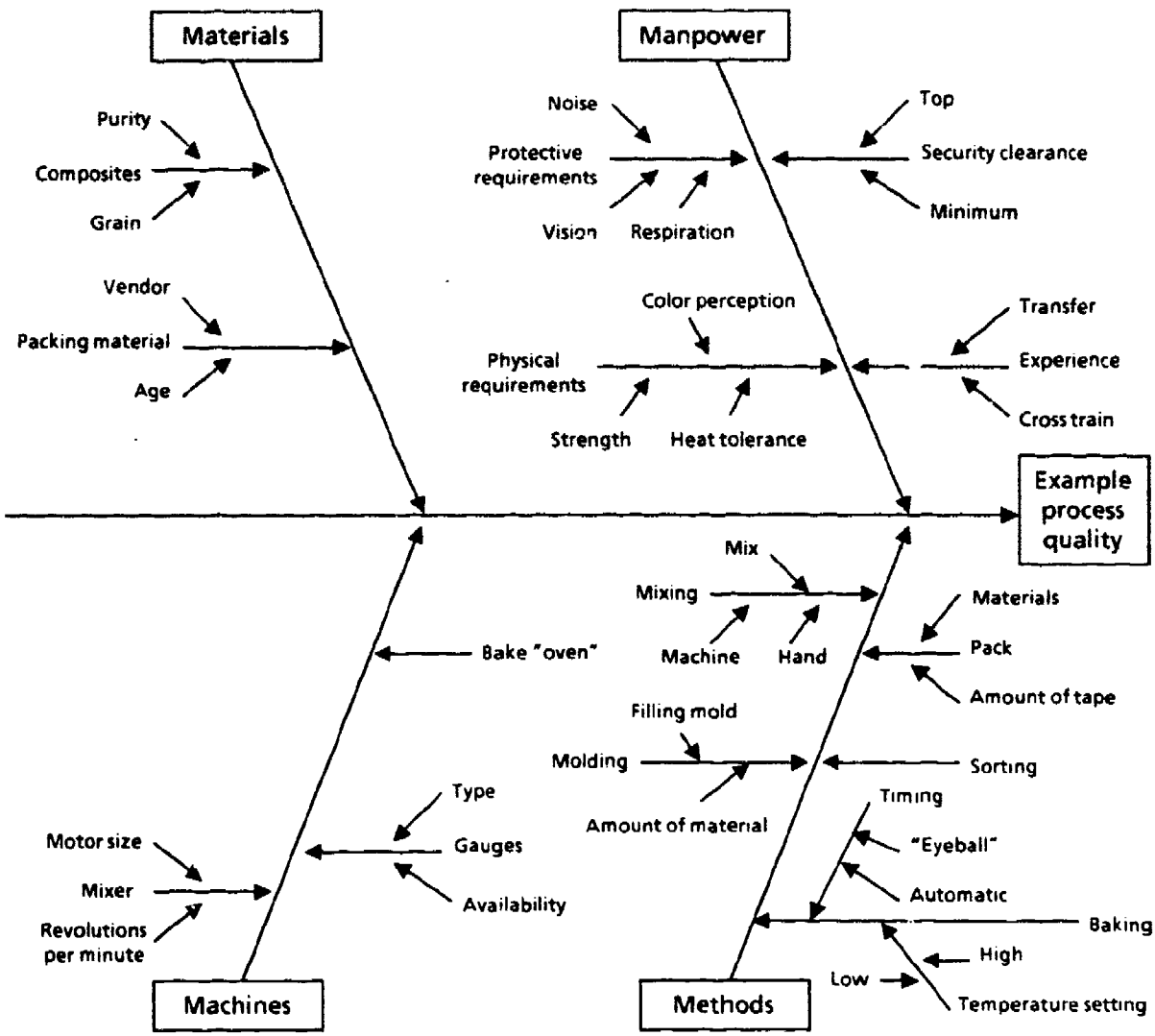


FIG. 4-12. CAUSE-AND-EFFECT DIAGRAM

Task descriptions, as illustrated in Figure 4-13, are used to define step sequence and methodology for tasks where uniform execution is important.

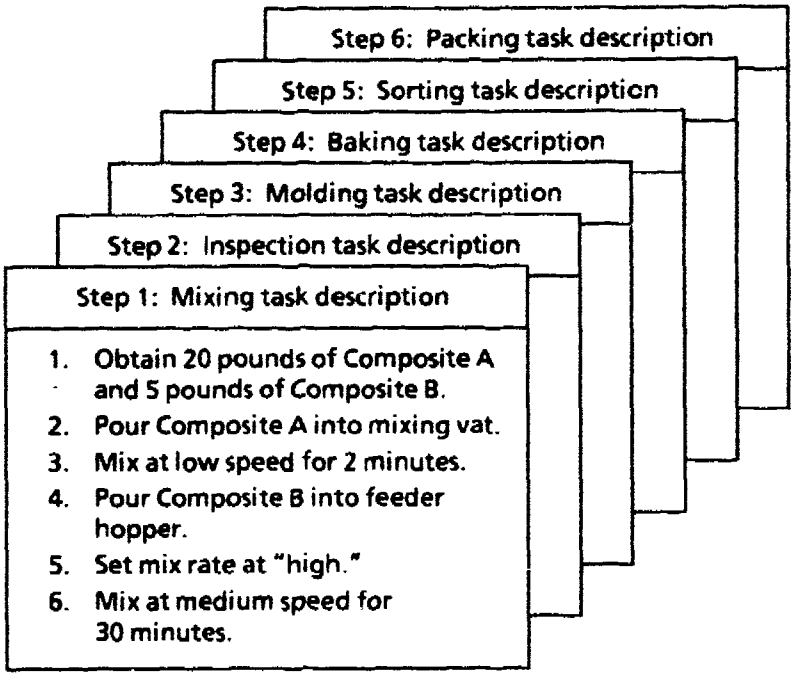
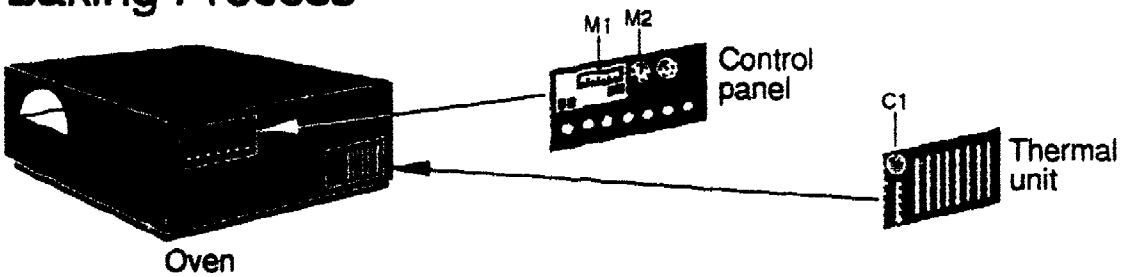


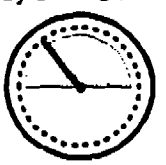
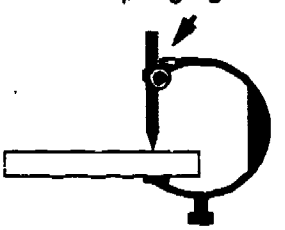
FIG. 4-13. TASK DESCRIPTION SHEETS

The process standard sheet displays information in a ready reference format and contains managerial and technical information considered essential to achieving quality objectives and customer requirements. It is illustrated in Figure 4-14.

The process standard sheet is an important tool in reducing work performance variation. The managerial information it contains may include policies, rules, objectives, goals, and targets. Its technical information may include critical dimensions, work methods, measurement techniques, materials, equipment, process control methods, and specifications. The process standard is much more than a job description, it is a guide to job accomplishment that provides sufficient detail and clarity so a new employee could do the job right the first time simply by precisely following the standard.

Process Standard Sheet: Baking Process



Control factors	Temperature	Time	Thickness
Control standards	1250° (±5)	30 min (±1)	.015" (±.001")
Checking method	Temperature gauge M1 	Timing meter M2 	Thickness gauge L729.6 
Checking interval	Prior to mold insertion and every 5 min	Set prior to insertion remove within 1 min after finish light L1	Prior to insertion of mold
Control method	Thermal unit adjustment C1		Calibration of gauge monthly
Control procedure	Adjustment of one increment changes temp by 5° C1 		Take reading at top of gauge 

Policy: See Administrative Memorandum TB-041

Procedure: See Publication TB-041

FIG. 4-14. PROCESS STANDARD SHEET

In the past, work standards were typically work measurement devices prepared by management and dictated to the work force. Process standards under CIP are descriptive devices prepared by workers with the assistance of their supervisor. They all jointly take ownership of the process and the standard. The guidance documentation produced from the participative standard development process is understood and accepted by the work force because they produce it; it is more likely to be followed and produce self-disciplined job behavior because they own it. The process standard becomes the routine by which work is accomplished, the reference against which workers assess their own performance, and the baseline from which all improvement proceeds. The standard is not used by management as a weapon to force regimented performance but rather is used by the work force as a tool to facilitate performance improvement.

Management's aim is to replace the need for management-imposed discipline with employee self-discipline. It can do so when jobs are clearly defined and understood and when the workers have the means to control their own work. An unskilled worker will concentrate on following the instructions of a standard. The skilled worker will think about ways to improve the standard. In both cases the standard serves a very important role in establishing the reference for job accomplishment and improvement.

Management's job is to help people develop self-discipline by creating the systems and environment that enable and nurture such behavior. The manager's role is to enforce job accomplishment to the standard through monitoring, coaching, teaching, and reward and recognition. It is also to provide goals that are challenging enough to cause people to think in new ways about how the job might be improved. Finally, and most important, the manager must demonstrate the behavior and provide the signals that nurture and support employing the standards and the associated improvement concepts, principles, and practices.

Process standards employed in a supportive and stimulating environment help promote self-discipline. The standards need to be simple, objective, and unambiguous and should be made as conspicuous as possible through pictures, charts, instructions, and visual job aids, prominently displayed in the work area. Such conspicuous displays serve as reminders and quick reference devices about critical tasks, steps, dimensions, or rules. For example, if misalignment of a critical part has been a chronic problem, a simple diagram may be placed in a conspicuous

location to illustrate the proper alignment procedure for the part. Such a job aid can serve to reinforce job training, help foolproof job accomplishment, or highlight recent improvements or changes to the job performance standard.

Developing process standards may appear to some traditional managers to require too much effort and time to be worthwhile. Enlightened managers, on the other hand, understand that standards are essential and are the basis for process management and improvement. While sometimes appearing to be simplistic statements of the obvious, these standards capture and preserve job know-how and best practices. They reflect the best, easiest, and safest ways of doing the job, and they provide the basis for training, audit, performance measurement, and diagnosis. They are too worthwhile to suffer from lack of time and effort.

To standardize its processes, an organization must take the following actions:

- Document a policy that requires all processes to be described and standardized
- Provide training on the techniques and tools for process standardization
- Ensure that planning addresses all three phases of the standardization process
- Develop a capability to capture and maintain the process standards and to employ them for performance validation
- Make the definition of process standards a high and early priority in its improvement effort
- Develop training and guidance on the proper development and use of process standards
- Expect the process standard development to start as part of process-improvement team training activity
- Provide facilitation and support to the process-improvement teams to assure that the process standards are efficiently and consistently produced.

Maintaining Standards

Maintaining process standards requires discipline and deliberate action and is as important as creating them. Maintaining process standards requires an organization to ensure that jobs are performed in compliance with the documented

standard and that the written work standard reflects the latest understanding about the best, easiest, and safest way to do a job.

Maintaining process standards requires process measurement, control, and feedback loops. Those mechanisms are designed, implemented, and maintained by the team that owns the process, assisted by facilitators and technical experts as required. CIP managers understand that these measurement and control systems are designed to support process maintenance and management and not to serve as personnel evaluation devices. Managers therefore behave accordingly.

Managers and workers should understand that jobs are either done according to the standard or the standard must be changed. Therefore, the standard is routinely updated to constantly reflect the collective and current understanding of optimum process design and job performance. Maintaining job performance consistent with the process standard is the essence of self-discipline, and improving job performance collaterally means improving the standard.

Since the current standard always represents the accepted "right way to do the job," performance assessment can be closely linked to the standard. As long as the standard is being followed, emergent problems are system problems rather than people problems. Such problems can be attacked without assigning blame or attribution to individuals. Under the old management style, people were held responsible for problems virtually without exception. Under the control of process standards, the source of performance problems can be more readily isolated and systemic causes addressed without attributing blame to the worker. If an individual's performance is not in accordance with the accepted standard, corrective action can be taken in the form of additional training or positive reinforcement for performance according to the standard. If an individual is not capable of performing a job to the standard because of some physical or mental impairment, that person should be assigned a different task. In any event, blame belongs on the system, which must be improved; everyone involved has an interest in finding solutions because they collectively own the system and its problems.

The process-improvement team owns the process standard and has the primary responsibility for maintaining it. The process standard should be as complete as possible and reflect all the relevant process steps. It must be upgraded whenever any activity is dropped, added, or changed. Changes to the standard should be quick and

certain, and relatively free of time-consuming bureaucratic control. The responsibility for making changes rests with the process team and generally should not require approval beyond the team supervisor. Occasional performance audits should compare actual job accomplishment with the standard. Any observed activity that is not part of the documented standard should be questioned. If such activity adds value to the product, it should be incorporated into the standard. If it does not add value, it should be terminated.

To maintain its process standards, an organization must take the following actions:

- Develop a policy that makes the improvement team that owns the process responsible for maintaining the process standards
- Provide the training and the resources necessary to support standards maintenance
- Audit periodically to validate job performance against the process or job standards
- Ensure that work is done in accordance with the standards, and if so, do not blame the work force for defects or problems
- Recognize defects and problems as signals that the process standards must be improved.

Improving Standards

Standard improvement is a deliberate and disciplined practice of constantly introducing positive change. The improvement of a standard is integral to the larger effort of process improvement. Since a properly written process standard is a codification of the process as it should operate until the standard is changed, the current standard reflects the expected and "recognized" way to perform process jobs.

Since no process is ever perfect, however, no standard can ever be perfect. Therefore, the process standards must be dynamic. The process measurement system reflects variation that can be readily reduced; individuals conceive simple improvement ideas; defects, scrap, and waste point the way toward obvious improvement opportunities. Each of these events may signal a quick and appropriate change to the process. Before changing the process standard, however, the potential improvement should be tested and demonstrated to be superior and

only then made the new standard. At any given time, performance is measured against only one standard.

Routine process-improvement ideas are tested using the *Standardize-Do-Check-Act* (SDCA) technique illustrated in Figure 4-15.

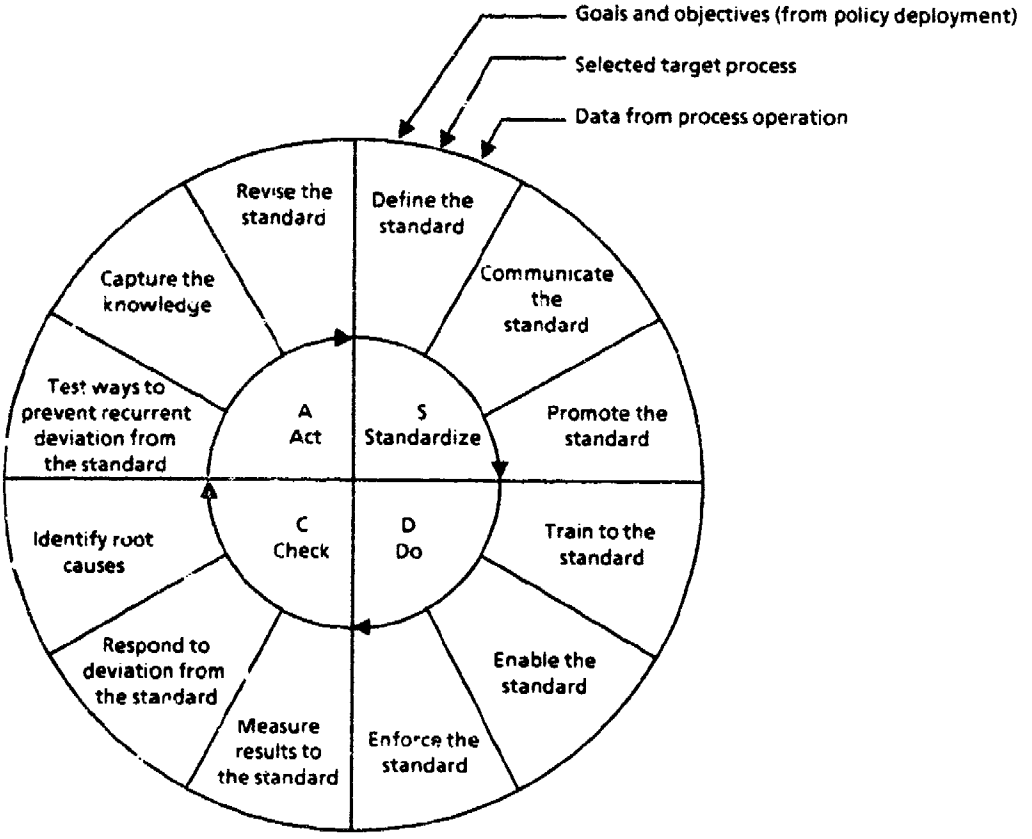


FIG. 4-15. SDCA PROCESS STABILIZATION CYCLE

The SDCA cycle is aimed at stabilizing the process, improving the process standard, and in particular, reducing the amount of performance variation. The design of SDCA tests is generally simple and the tests are short. Revision of the process standard, based on the results of the SDCA test, is built into the *Act* phase of the cycle. Management is kept appraised of the results of SDCA test results through involvement in the improvement process, supervisory approval of process standard changes, and process team oral communication of significant results with potential wider application. The team's decision to revise the standard is based on the data from the SDCA process-improvement test, not on intuition. Successful small process

changes are incorporated into the standard as most appropriate to ensure the improvement is not lost and the new "right way" is adequately communicated.

No improvement idea is too small to receive attention. Some good process-improvement ideas may, however, be too simple to require a full blown SDCA test. Simple ideas that can be implemented quickly and easily with obvious results and those requiring no process standard changes, may be acted on immediately. The originator simply discusses the improvement idea with the supervisor and is given a go/no-go decision as soon as possible. The ideas are implemented by the originator, evaluated for results, and where successful, documented so that the originator will be given due recognition and the standard may be updated as necessary.

An organization must expect process standards to be routinely upgraded as part of the overall process-improvement effort and question the long-term lack of change to any process standard. To practice standards improvement, an organization must take the following actions:

- Provide training on the methods and requirements for standards improvement, including the SDCA cycle
- Recognize and communicate that standards improvement is a process-improvement team responsibility
- Encourage the pursuit of improvements on a large scale and a small scale and reward and recognize originators of improvements accordingly
- Ensure that standards improvement is a positive, simple, and nonthreatening process for the worker.

Improving Processes

Fundamentally, CIP is totally concerned with improving processes since everything an organization does is part of a process. When an organization stops improving its processes, it starts dying. Improvement is a change process, and a truly mature CIP organization is one in which all its people are excited about, hungry for, and eager to contribute to continuous constructive change.

Hunger for change results from a positive level of dissatisfaction with the status quo and a strong belief that processes can always be improved. Process improvement begins with top management and is diffused throughout the organization to affect every activity and become part of the standard operating

environment. Process improvement is powered by top-management commitment, directed through strategic planning, promoted through team structure and personal involvement, produced through disciplined individual and team activity, and rewarded promptly and positively.

The core of process orientation and improvement lies in disciplined individual and team activity. Such activity is required in the process simplification and standardization discussed above. It is also central to process improvement. The simplification process eliminates most of the obvious non-value-added process elements. Standardization produces process documentation such as flow diagrams, cause-and-effect diagrams, and task descriptions as well as creating process measurements, controls, and feedback loops. With these procedures in place, the teams work systematically to reduce process variability and improve process standards using the short-duration SDCA improvement cycle.

Implementation of major process-improvement ideas requires time and planning. Such ideas are tested with a more rigorous variation of SDCA, the *Plan-Do-Check-Act* (PDCA) experimentation or learning cycle as illustrated in Figure 4-16. PDCA experiments are generally more complex, more uncertain, and of longer duration than SDCA tests.

PDCA learning cycles are conducted by process-improvement teams with the support of facilitators or technical experts as required. The cycle begins with a general objective or perceived opportunity for process improvement and proceeds through preplanning analysis, planning, training, measurement system development, implementation, data collection, evaluation, and institutionalization of successful process changes in process standards.

A typical PDCA cycle may run 3 months while complex experiments may run considerably longer. A PDCA learning cycle is not complete until the team has developed its PDCA story to present the experiment's objectives, results, and process improvements to its parent improvement team. Likewise, some form of management recognition of the team effort and its results is an important part of PDCA cycle closure.

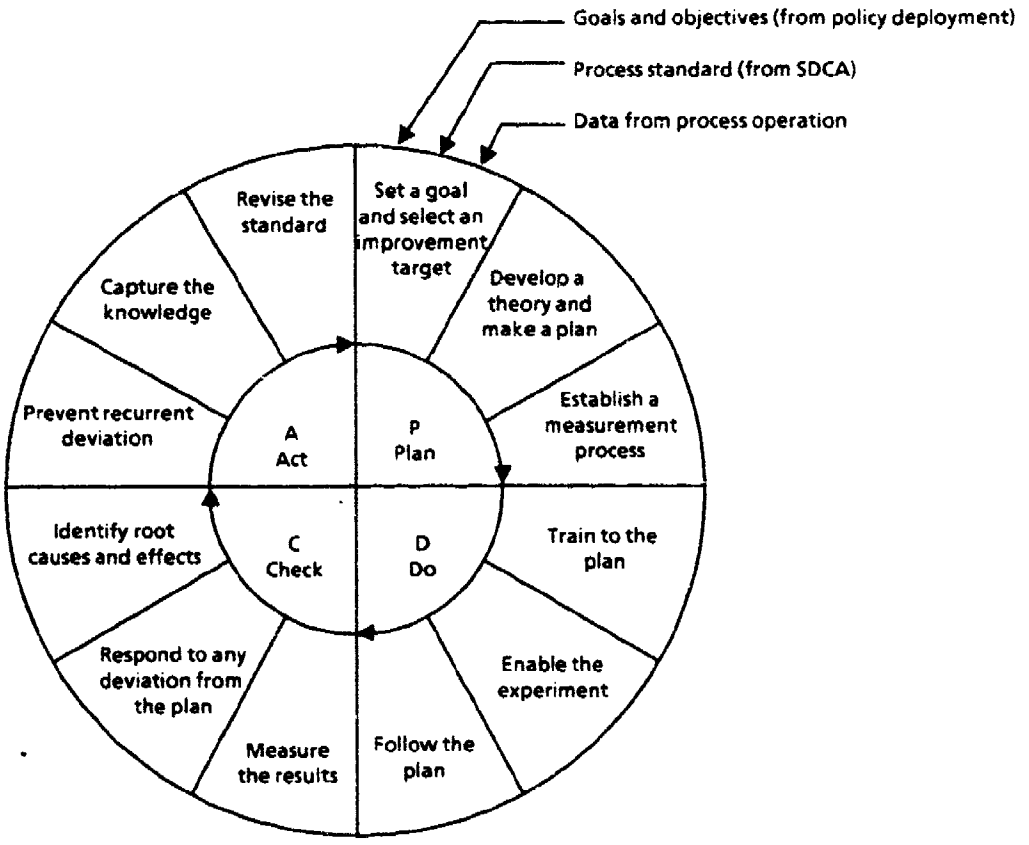


FIG. 4-16. PDCA PROCESS IMPROVEMENT/LEARNING CYCLE

To continually improve its processes, an organization must take the following actions:

- Demonstrate an unambiguous commitment from top management to understand and improve all its processes
- Provide clear objectives and guidance for process improvement through its strategic planning
- Develop a network of process-improvement teams that take ownership of their processes and work systematically for their improvement using simplification, standardization, and improvement methods such as PDCA
- Ensure that every individual is encouraged and has the opportunity to participate in process-improvement activity

- Expect every process-improvement team to be working on at least one process-improvement project at any given time
- Provide timely reward and recognition for process-improvement effort and results.

SUPPORT OF CUSTOMER FOCUS

Customers are ultimately the reason for, and the means of, existence for an organization. Quite simply, an organization is a group of people doing something for somebody else. How well that "something" is done and how satisfied that "somebody" is bears directly on the ability of the organization to grow and survive. Performing its mission well and satisfying its customers requires an organization to have a constancy of purpose and a commitment to quality and service, and customer focus is an underpinning of both.

The organization must continually reassess its customers' needs and requirements and consider them in its improvement efforts. Customer focus -- both internal and external customers -- and involvement starts with top management and extends down through every level of activity. Every individual and team has customers and must know and communicate with them. The individuals and teams must define and translate customers' needs and expectations into actions that positively influence the processes that create products and services.

Researching External Customers

Customer research is a process of gathering, analyzing, and assimilating information about customers that helps the organization understand, better satisfy, and expand its customer base. Satisfying customer requirements is a primary objective of the CIP organization, and conducting market research is one practice that helps achieve that objective. Customer research may extend well beyond the traditional definitions of research to include involving customers in team problem-solving activities; developing employee exchange programs with customer organizations; creating better communication and feedback mechanisms; and building stronger ties between customer and field service functions and the marketing, engineering, and manufacturing functions.

Market research is an important mechanism for providing customer focus. However, use of the customer information so obtained is frequently too narrowly restricted. Market research may be the responsibility of the marketing department or even an outside consulting firm, and the products of the research are often limited to the development of marketing strategies or, at best, new product development. Yet, customer-focused continuous improvement requires the engineering, manufacturing, service, and other nonmarketing functions to better understand and take into account the customers' needs and expectations.

Top management in the improving organization carefully examines the overall need for customer information and designs its market research and information systems to gather and disseminate that information on a broader basis. More attention is given to customer service, product failure, response time, customer complaints, late delivery, returns, and other information sources. The nonmarketing functions participate more actively in customer-focused team activity.

Organizations serving a few major customers may develop employee exchange programs under which some individuals work for a time inside the customers' operations. Properly designed exchange programs can provide important insights that might be impossible to gain through the typical market research mechanisms. While exchanges may involve people from any area or from any level of the organization, they should be between personnel in areas that have definable supplier-customer relationships. Each individual should return with an enriched understanding of the needs and problems of his/her counterpart, whether supplier or customer. These insights should then be fully exploited by management to produce constructive change.

Improving organizations also place greater emphasis on developing responsive communication and feedback channels with customers. Rapid response to customer inquiries, complaints, or problems is a high priority. Top executives or responsible functional area managers rather than the customer service representative may be responsible for responding to the customer. Some organizations go so far as to give customers direct access to internal databases containing production schedules, shipping dates, or other information of relevance to the customer.

To conduct interactive customer research, an organization must take the following actions:

- Make customer focus a cornerstone of its business and improvement strategies
- Emphasize through training the importance of understanding and responding to customer needs
- Expand market research to include engineering, manufacturing, and service personnel and information
- Develop employee exchange programs with major customers where feasible
- Create responsive channels for customer communication and feedback.

Addressing Internal Customers

Customer research also addresses internal customers and engages them in active dialogue. Understanding and responding to the needs and expectations of these customers is essential to identifying problem root causes and stimulating process-improvement activity. The dialogue with internal customers also focuses on customer satisfaction. Both the internal and external customers are regularly asked about perceptions, needs, and expectations with respect to the products and services received. Performance measures are defined and implemented to track the factors correlating with satisfaction.

Among the techniques that may be employed to gather information are surveys, audits, meetings, and participation in improvement team activity. Internal customers in particular should be included in team process analysis and in PDCA improvement cycle activity.

To address its internal customers, an organization must take the following actions:

- Provide a policy that requires each individual and process team to know its customers and have regular dialogue with those customers
- Address the importance of communication and stress communication skills through training and facilitation
- Establish regular and formal processes for obtaining information about customer satisfaction

- Ensure that both suppliers and customers understand the purpose of formal information gathering, such as surveys, and ensure that the results are shared with the work force
- Have a measurement system that relates customer satisfaction to process performance
- Ensure that the requirements and measurements of internal customer satisfaction are compatible with external customer needs.

SUPPORT OF CONTINUOUS IMPROVEMENT

Continuous improvement requires a commitment to stay the course and the discipline to rigorously employ the practices, techniques, and tools of improvement. Discipline means tenaciously chipping away at waste, inefficiency, and errors using methods that work even when the effort may seem long and difficult. It also means avoiding the temptations to apply quick fixes, use fads, and adopt simplistic solutions in hopes of discovering the easy way out. Structure, disciplined methodology, and steady commitment combined with knowledge and the empowerment of people is a certain road to continuous improvement.

Promoting Small Improvements

To promote small improvements, the organization must enlist the efforts and ideas of many people to make numerous and constant small changes to existing work processes and systems. Substantial productivity gains are made through small improvements in the man, machine, method, or material components of system design without the infusion of costly new technology. When given appropriate responsibility, authority, and support, individuals and teams will readily identify opportunities to change poor work methods, eliminate non-value-added process steps, and reduce and remove the sources of defects and waste. They will discover opportunities for small improvements in existing tools and equipment to increase reliability, dependability, accuracy, durability, ease of use, and safety. The experience of improving companies shows that the net benefit of stimulating many small improvements is often greater than that from major infusions of new technology, and at a fraction of the cost.

In Japan, *Kaizen*, an organized and disciplined approach to promoting small improvement, has evolved. *Kaizen* is a Japanese word that means "continuous 'change for the better' resulting from many small steps." It is aimed at getting the

most out of systems by the optimal use of conventional technology; it is process-oriented; it relies on the efforts of people rather than on investment to produce change; and it is a potent means for producing system improvement through both team and individual efforts. Management actively facilitates small improvements and participates in the improvement process.

An objective of promoting of small improvements is the simplification of work processes to make them easier, faster, safer, and more efficient. Process simplification should precede the application of new and innovative technologies to avoid institutionalizing old problems in the new systems. By improving existing systems first and wringing out inefficiencies before automating, organizations can avoid mechanizing bad practices, waste, and inefficiencies. Only after individuals and teams begin to exhaust their ideas for improvements in the man, method, machine, and materials aspects of their existing system should a process become a prime candidate for major investments in new technology like robots, flexible manufacturing, or automated storage and retrieval systems.

Continuous Improvement Process management actively promotes small improvements by giving real process ownership to individuals and teams and by moving the authority to approve system enhancements, within appropriate boundaries, down as low as possible into the organization. First-level supervisors are authorized to approve low-cost, low-risk process-improvement ideas on their merits without requiring a cost justification. Management encourages creative thinking, moderate risk taking, and experimentation with room for failure. However, management does require that experiments and changes be accomplished through a disciplined methodology with appropriate planning, performance measurement, and analysis to ensure that results are understood, communicated, and rewarded.

Small improvement activity applies equally to management, process-improvement teams, and individuals. Cross-functional management teams concentrate on simplifying and improving the organization's important strategic and logistics processes. The teams seek to routinely apply constant small enhancements to obtain quality with efficiency, minimize inventory, reduce work effort and requirements, improve process flows, and increase communication effectiveness.

For example, a cross-functional management team is assigned to improving the flow of materiel through a production facility from the receiving dock to the shipping dock. However, before the team thinks in terms of major technological innovations, it must focus on understanding the existing process flow, identifying and eliminating non-value-added activity, breaking down bottlenecks and barriers, reducing in-process inventories, streamlining materiel flows with better floor layouts, and identifying defect-prone processes for special attention. The team immediately addresses each discovered process problem with appropriate small corrective actions whenever possible. By studying the existing system and improving it to the extent possible within the existing technologies, the team will gain the process knowledge it needs to make the best use of the new technologies if they are required.

Management directs its small improvement activity toward systems improvements in design, production, planning, decision-making processes, information systems, interorganizational relationships, and broad application processes. Process-improvement teams focus on the processes they own and generally introduce their small improvements through PDCA improvement cycle activity. In some organizations, teams designate a member to serve for a time as a roving scout for process-improvement opportunities. That position may be rotated from time to time among the team members. Small group activities may also be organized to focus on safety, housekeeping, equipment maintenance, or similar narrowly defined issues specifically to bring small improvement ideas to bear on areas of interest that cut across process-improvement-team boundaries.

Individuals, including managers, must also devote time to improving their own jobs through small incremental changes. The management system must recognize and reward individual improvement activity as surely as it does group activity. One mechanism for this is a healthy and responsive suggestion system. A second mechanism for stimulating small improvement ideas is the process-wide or organization-wide improvement theme. For example, the organization may announce an improvement theme for a specified time period to produce "ideas to simplify and eliminate the unnecessary," or "ideas to speed processes and maintain quality." A third mechanism for promoting individual small improvement initiatives is to foster a true sense of job ownership by giving individuals and teams the discretion to design or tailor their own pieces of work processes as well as the

responsibility for measuring and monitoring improved performance and their customer's satisfaction.

To promote small improvements, an organization must take the following actions:

- Develop a clear policy on pursuing small-step process improvements to optimize the use of existing technologies and systems before approving major investments in new technologies
- Train teams and individuals, including managers, on the methods, themes, and importance of small improvement initiatives
- Develop a simple and responsive suggestion system to capture, recognize, and reward small improvement ideas
- Foster team and individual ownership of job processes by moving responsibility, authority, and control over improvement to the lowest level possible
- Develop a disciplined change methodology for managing change and a measurement system at the process level to track performance and to ensure that the change process yields human knowledge as well as physical process improvement.

Research and Development – Innovation

Research and development is an important engine for change in the CIP organization as it is in many other organizations. Continuous improvement occurs through the small-step changes based on current technology and big-step changes based on technological breakthroughs, or innovations, that come principally through R&D. These two vectors for change – small-step changes and big-step changes – exhibit a logical relationship and a powerful synergy. Management that can successfully integrate them will have a strong competitive advantage over those that cannot.

Small-step improvement and R&D-based innovation interact in a continuous improvement cycle. While improvement through many small steps as exemplified by *Kaizen* is continuous, innovation through R&D is periodic and subject to substantial performance effectiveness decay between steps. Sustained high-level and effective performance growth require an organization to employ the power of continuous small-step improvements and periodic step-function innovations as illustrated in Figure 4-17.

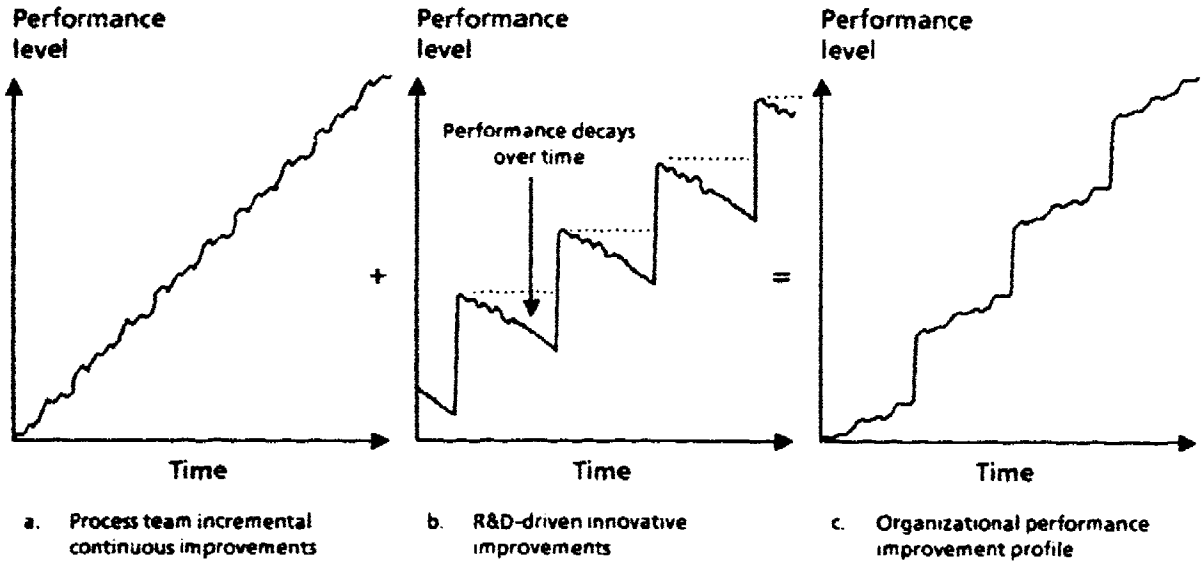


FIG. 4-17. R&D PLUS PROCESS TEAM ACTION YIELD OPTIMAL IMPROVEMENT

When an innovative new technology is first introduced, the variation is usually substantial during an initial period when defects or problems have yet to be ironed out. During that initial period, while the technology is immature, the organization has a great opportunity to stimulate small improvement activity, and the effects of *Kaizen*-type efforts can be dramatic. As the new technology is improved over time, it becomes progressively more difficult to find additional opportunities for incremental small-step improvement. When the easy and obvious improvements have been made, additional effort only produces diminishing returns as attention shifts from improvement toward maintenance. Once a technology reaches maturity and its full potential for growth through improvement starts to level, it is time for another innovative change.

For example, in the very simple process of mowing a lawn, the first technological innovation may be employing a manual push-type mower. Major small-step improvements involve determining optimal mowing patterns and weather conditions and developing an energy efficient technique for pushing the mower. As the small-step improvements yield to maintenance, attention is turned to the next innovative improvement, perhaps the purchase of a power mower. That innovation will bring its own peculiar small-step improvements, especially since not all the previous improvements will apply to the new technology.

While everybody is responsible for generating small improvement ideas, a select few are primarily responsible for the R&D search to discover and apply new technologies and innovative solutions, and that search requires specific and focused funding. The CIP organization funds R&D efforts to produce the innovations required to replace maturing technologies and to counter competitive technological advances. As with all of the other CIP activities, R&D has a customer focus, but it also should have some orientation toward pure research to press outward the boundaries of the chosen technologies. The level and balance of funding between applied and pure research is a management decision that should be addressed in the organization's strategic planning.

The relationship between numerous small improvements and large-step innovation must be recognized by management and reflected in both the long-range and short-range planning of the organization. The organization that focuses exclusively on only one of these change vectors will be at a serious disadvantage. The organization's strategic plan should contain a balanced and strong commitment to both R&D for innovation and small improvement ideas to generate continuous improvement.

To promote R&D and innovation, an organization must take the following actions:

- Develop an R&D policy that is appropriate for the nature of the business and that will provide sufficient resources to develop the innovations required for timely and sustained improvement
- Train R&D personnel in the appropriate CIP practices, techniques, and tools and encourage their application to both applied and pure research efforts
- Establish goals and objectives for R&D that are consistent with the organization's constancy of purpose and commitment to quality
- Ensure that the R&D effort and the small-step component of the improvement process are deliberately integrated.

Measuring Performance

Performance data are vital to the CIP organization since decisions are based more on the evidence of data than on opinion or intuition. Statistical information becomes a familiar tool to managers, administrative personnel, and laborers alike.

Performance measurement becomes the basis for identifying problems, evaluating solution alternatives, and judging improvement.

An important concept of CIP-based performance measurement is that individuals and teams are responsible for their own performance measurement systems. The organization signals its trust in the teams and individuals by allowing them to own their measurement systems along with their processes. By giving the team ownership of both the process and the measurement system, the organization avoids several important and traditional roadblocks. First, the roadblock of fear is reduced because the data are no longer used by management to fix blame but rather used by the process team to identify and correct problems and improve their process. Second, the roadblock of lack of visibility is reduced because the people closest to the problems and charged with their correction are the same people making the measurements and evaluating the data. Third, the roadblock of poor communication is reduced because fewer people must translate and communicate the messages in the measurements, thus speeding response times and enhancing the accuracy of corrective actions.

Training people in the correct methods of performance measurement and in data analysis and interpretation is an essential task. The extent of the training varies depending on the nature of the processes and jobs involved. However, everyone in the organization should be sufficiently trained in measurement and statistics to permit him/her to understand, control, and improve his/her respective processes.

The CIP organization may also provide the technical services of a professional statistician to work with teams and individuals when they need help in establishing their measurement systems or in interpreting measurement data. This same statistician may be used to conduct statistical training and to perform roving audits of the process measurement systems to assure that they are maintained and operated correctly.

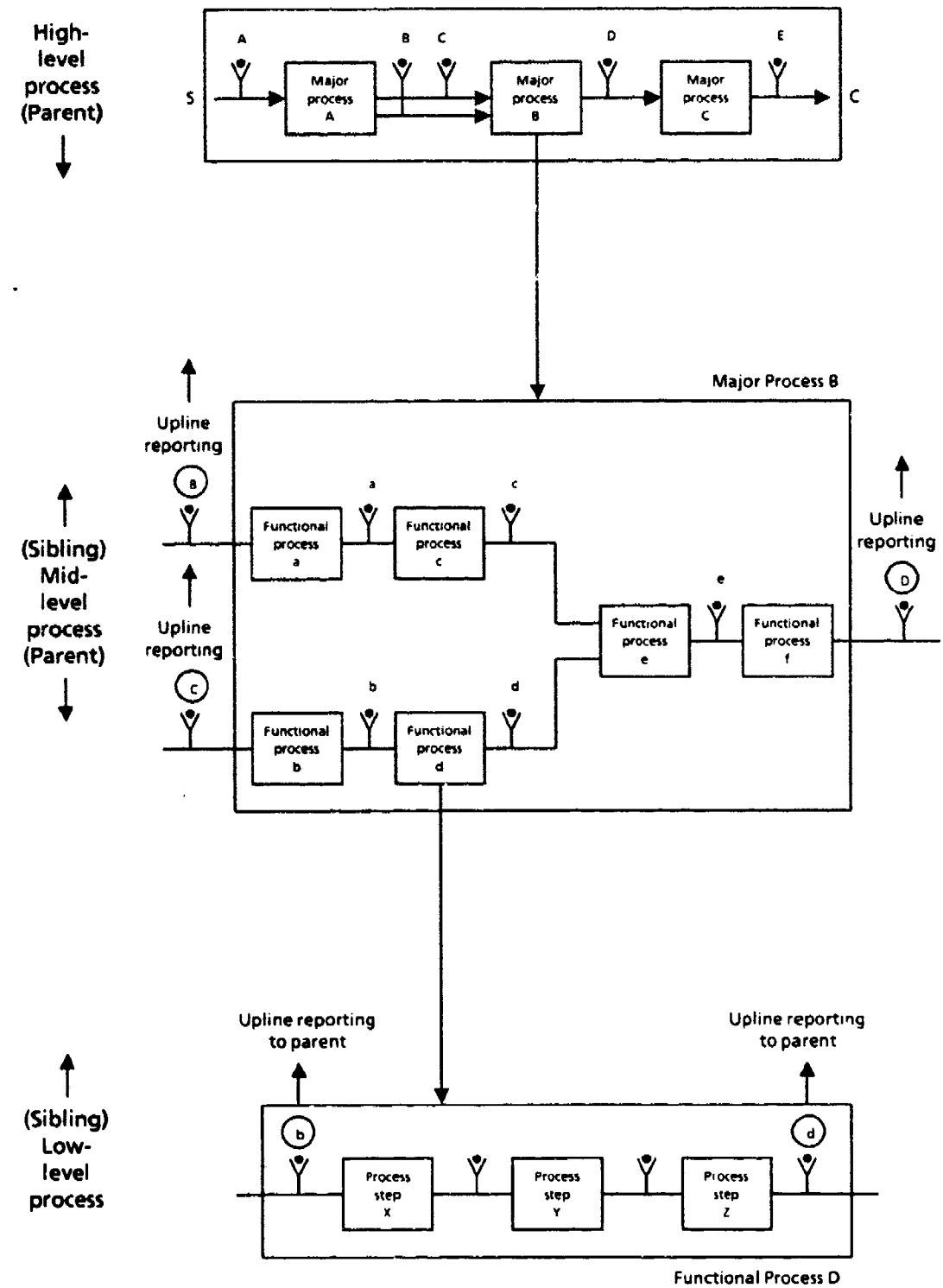
Continuous Improvement Process-based measurement systems function more as tools for the control and improvement of processes and less for higher level reporting than in the traditional organization. However, some data from each process performance measurement systems are tagged for higher level reporting. In

particular, the data that constitute a checkpoint or control point for the next higher (parent) process team must be routinely communicated, as illustrated in Figure 4-18.

The vertical linkage between process teams and measurement systems provides the framework for both downward policy deployment and upward performance feedback. To reiterate an earlier point, however, CIP management does not use the performance data and feedback system to target blame or apply pressure but rather uses them to identify improvement needs and to target management assistance.

Improvement team activity introduces performance measurement to every process and relates it to every job. While the process-improvement teams perform their own measurements to control and improve their own processes, they are required to maintain accurate process performance data histories. Measurement data are captured and retained as part of process capability documentation. This information may be retained by the teams or stored in central archives depending on the needs and objectives of the organization. Organizations with requirements for providing data to the Government or to a customer may seek to develop a single central database for key performance information.

Measurement system integrity is maintained through the combination of cultivated pride of process ownership, trusting and supporting signals from management, and professional periodic audits of the process measurement systems to ensure that the design and operation are correct and to assist the teams in maintaining and expanding their measurement system. Performance measurement is not used for reward and punishment but rather for process control and improvement. The CIP organization does more measurement earlier, more rigorously, and more frequently than the traditional organization and involves more people in it. The results are fewer defects, shorter times, lower costs, and better morale.



Note: Y = performance measurement point

FIG. 4-18. UPLINE REPORTING OF PARENT PROCESS CHECK-POINTS

To practice performance measurement, an organization must take the following actions:

- Increasingly base its decisions and actions on statistical evidence and rely less on intuitive approaches
- Develop a performance measurement policy that makes the teams or individuals who own the process responsible for process measurement systems
- Provide some level of training in measurement and statistical methods to all personnel
- Use performance measurement data to identify improvement needs and to target assistance, not to fix blame
- Provide professional performance measurement assistance in the form of a statistician or other qualified person
- Ensure integrity in the measurement system by promoting pride in process ownership, sending trusting and supporting signals, and appropriately auditing the process
- Increase vertical and horizontal communication and assist the coalition of a process team network by requiring the exchange of measurement data of mutual interest
- Maintain performance information in accordance with the needs of the organization and the requirements of the customers.

Improving Through Projects

Improvement projects are frequently undertaken to concentrate attention and effort on achieving a specific objective or addressing a particular problem. A project may be undertaken by a team of people selected specifically for the task or by an existing process-improvement team. In either case the project has a specific objective to be achieved within a specified period of time and is aimed at surmounting one or more improvement steps along the climb of continuous improvement as illustrated in Figure 4-19.

Select project teams are typically temporary groups assembled only for the duration of the effort and comprise people carefully chosen because their knowledge or specific skills apply to the task at hand. For example, consider a select project team assembled specifically to review and improve acquisition and contracting guidance, rules, and regulations. Such a group should have a member who

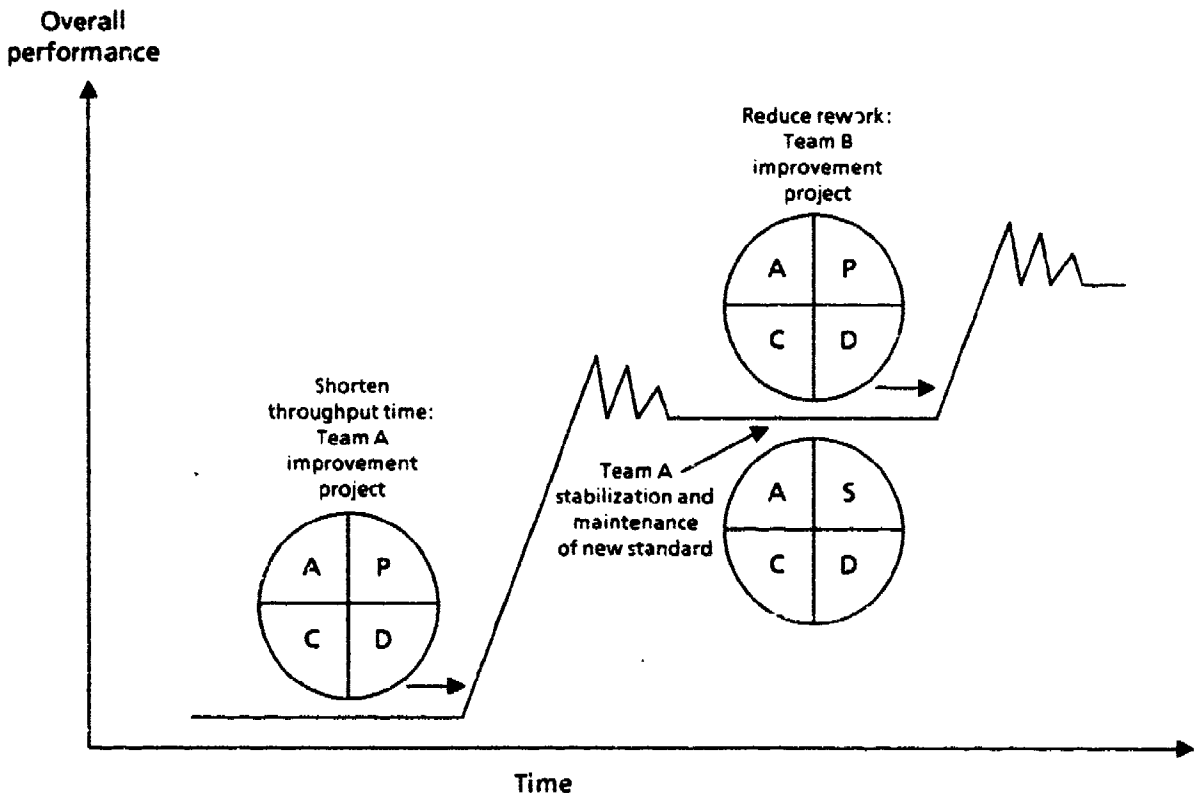


FIG. 4-19. IMPROVING THROUGH PROJECTS

understands the legal aspects of the issues, one who understands the perspectives of the contractors, another with the perspective of the contract administrators, a fourth representing the views of the legislators or policy makers, and so forth. Balanced representation on a project team is essential to ensure that the issues and perspectives of all those directly affected are given adequate voice. Taking the full range of customers into account and seeking a consensus solution is generally a key to ultimate acceptance of the results and doing it right the first time.

Structuring project teams with full customer representation and seeking consensus on solutions may not always be the fastest or easiest route to a solution, but it is generally the best route to the right solution. Consensus-seeking requires that conflicting perspectives and interests be addressed and resolved, and to do so, each team member must enter the project processes with an open mind and a willingness to compromise. Top management in the organization must set the tone and send the right signals to the project team members with respect to cooperation,

coordination, and desired outcomes. Top management must also ensure that the project team members are trained in CIP and understand its principles, practices, techniques, and tools as they relate directly to the project subject matter.

Process-improvement team efforts can also be focused through PDCA projects. Process-improvement teams' PDCA projects are defined in cycles, as illustrated in Figure 4-20, such that a team is always working on a project aimed at improving some aspect of the team-owned process. Each PDCA cycle is completed in a specified time period, for example, 3 months.

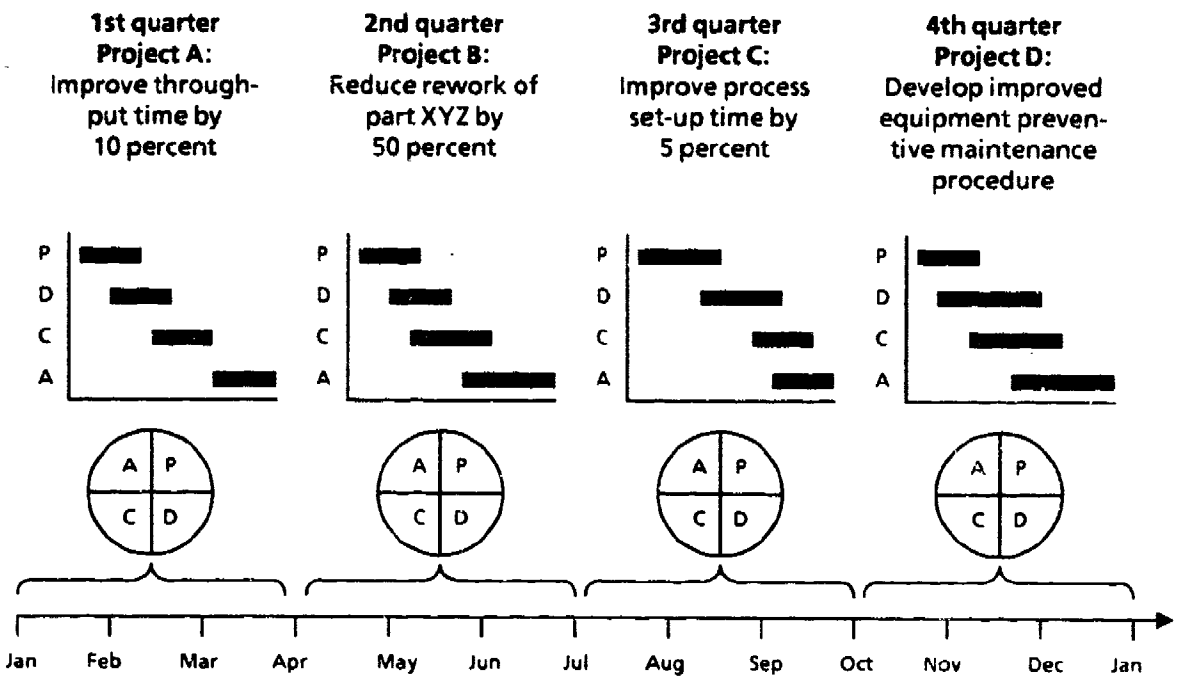


FIG. 4-20. CYCLIC NATURE OF PDCA PROJECTS

The project cycle includes all activities, from selecting the project objective through planning, execution, evaluation, and reporting. A process-improvement team project cycle is typically one rotation of the PDCA cycle. Each PDCA cycle has a goal to be achieved and that goal requires concentrated effort but is achievable in the project cycle time and is relevant to the overall improvement process. Project results are reported in the form of a PDCA story at the end of each cycle.

Process-improvement-team projects are generally focused on achieving goals that are logically related to the goals of the parent team and the overall goals of the organization. The objectives of a single turn through the PDCA cycle are defined by the team members and approved by their direct supervision. The duration of the PDCA cycle depends on the complexity of the process and the difficulty of the selected objective. Projects must be long enough for a well-designed and thorough effort or experiment and yet be short enough to demand quick attention and progress. When a project is completed, the results are documented, backed by data, and formally presented in the form of PDCA stories.

To seek improvement through projects, an organization must take the following actions:

- Follow a policy of structuring project teams with qualified people representing the perspectives of all the suppliers and customers affected by the improvement project
- Train project team members in all the relevant CIP disciplines
- Ensure that projects are properly planned and executed, have specific goals and objectives with defined time requirements, and have sufficient management guidance and support to deal with potential roadblocks
- Require process-improvement teams to routinely engage in a process-related improvement project and, in general, conform with the discipline of the PDCA learning cycle.

Communicating with Data

In the CIP organization, data, particularly statistical data, become a common language for communication. Data define the performance and capability of processes. Improvement is confirmed and rewarded on the basis of statistical evidence. Processes are studied and assessed using data that reflect the voice of the process. Data are used to reflect and communicate the voice of the customer and to assess customer satisfaction. Management discussions and decisions employ and depend on the hard evidence of data more than the traditional organization.

Many traditional organizations are data rich but information poor. CIP organizations, on the other hand, attempt to limit the collection of data to those that are useful. They recognize that becoming information-rich is one of the keys to organizational success in the Information Age. However, they also recognize that

the degree to which an information-rich organization can appropriately use its information is a function of how widely that information is disseminated and how many people in the organization are able to use it for constructive purposes. Thus, in the CIP organization, every member is responsible for collecting and analyzing data and for interpreting and responding to the information content.

That greatly diversified responsibility for collecting and analyzing data infuses the entire organization with a new power to control and improve its numerous processes. However, this power does not come without an investment; the organization must train its people in the techniques and tools of data management. That training includes instructing people in fundamental statistical methods; providing professional technical support for the proper design and employment of data systems; and providing the necessary tools for data management, including computer support where necessary. Additionally, management must send clear signals to the organization about the importance of good data and its proper application. To do so, top and middle managers must insist on data to support their decisions and actions and use those data properly.

The organization should make readily available and highly visible all data relevant to a broad spectrum of the organization. Important performance and improvement data are routinely and publicly posted. Data that reflect the condition and direction of the organization are shared with each stakeholder. Some organizations establish viewing rooms where key performance data are routinely posted. Such rooms also generally serve as meeting rooms for management or process-improvement teams.

To use data to communicate, an organization must take the following actions:

- Establish a clear policy of basing management decisions and actions on the evidence of data rather than on opinion
- Train all personnel on the proper collection, analysis, and use of performance data
- Provide the necessary resources, tools, and technical support to ensure that data are appropriately, efficiently, and effectively used
- Emphasize the importance of relying on data by calling for the use of data in discussions and meetings and by posting important data prominently and in a timely manner

- Send clear signals that good data are essential and valuable by limiting the requirements for data to those that are useful and used.

Reducing Process Variability

Variation is the degree of change or divergence among the members of a set or group. For example, variation is evident in the uniqueness of individual faces, fingerprints, and snowflakes. Similarly, the products and services produced by organizations exhibit a measurable diversity. While variation and diversity are desirable in many systems – the earth's ecosystem, for example – they are undesirable from a quality control or production process management perspective.

Process variability has a virtually infinite number of causes, only some of which are controllable. Two principal causes of product performance problems are poor product design and poor process design, both of which lead to variations that result in product wear, early failure, unfulfilled expectations, and ultimately customer dissatisfaction. Such problems are costly for the consumer and the producer. Poor quality, high costs, or missed schedules that are caused by process variation produce unnecessary repair costs, lost productivity, frustration, inconvenience, low customer satisfaction, and ultimately lost business. Both the design and the process problems can be minimized with simple, low-cost management methods. Variation in processes can be controlled and the number of incompatibility problems reduced by training employees in and requiring the proper application of statistical methods.

Variability is a primary source of defects and waste. It exists everywhere in every process and product, and it can never be totally eliminated. However, the amount of variability in processes and products can be controlled and reduced by applying several simple and straightforward statistical techniques and tools. The concept of reducing variability lies at the heart of such important CIP techniques as classical process control and design methods. Reducing variability is the primary objective of those statistical methods, and it is a core discipline of process-improvement-team activity.

Just as we accept that no two snowflakes, two fingerprints, or two people are exactly alike, we also accept that no two outputs from any process are exactly alike. Measurement detects differences among the outputs, and the amount of variation in

a set of measurements can be represented graphically in a chart that shows the distribution of variation around the average output (see Figure 4-21).

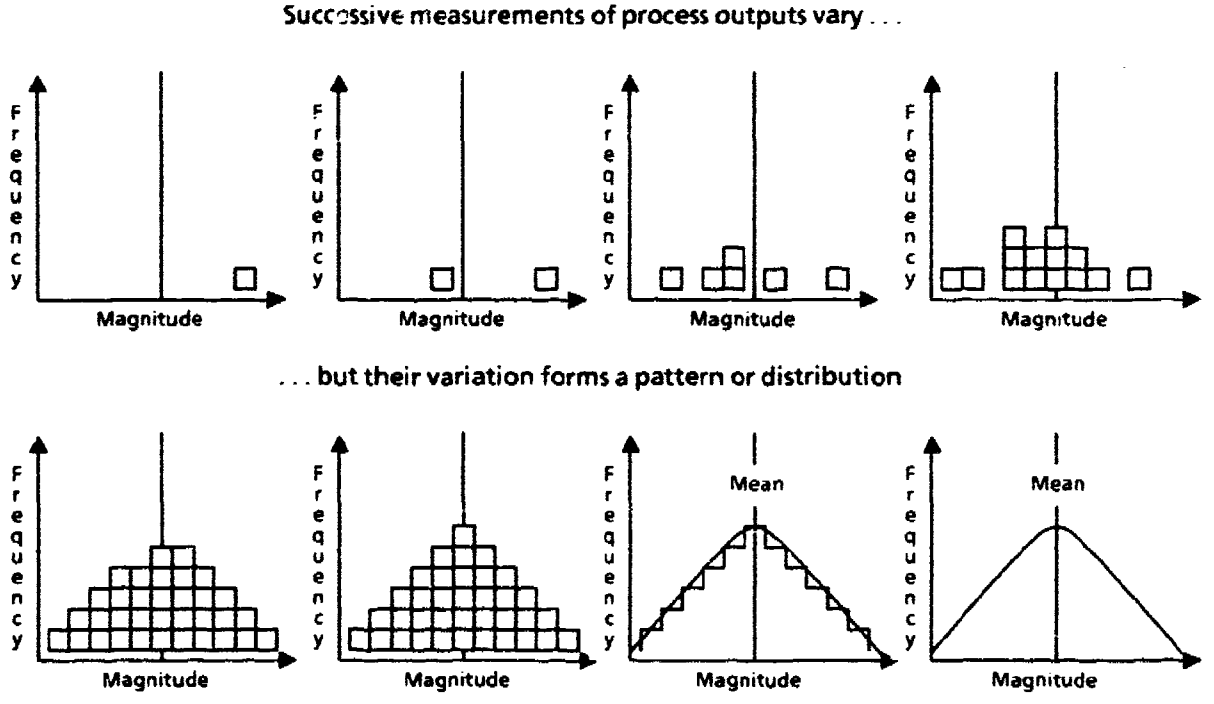


FIG. 4-21. DISTRIBUTION OF VARIATION

Since a process produces its output for a customer, the producer must understand as well as possible the customer's real requirements and must translate those requirements into the ideal output (the voice of the customer), as illustrated in Figure 4-22.

The distribution of output variation represented in Figure 4-22 reflects the existing inherent inability of the process to achieve the ideal or target output as defined by the voice of the customer. The variation in the measured output is in fact the voice of the process. This voice of the process can be compared with the customer's requirements (voice of the customer), and the inherent process capability to meet customer needs can be determined and quantified. The ability to quantify process capability can be an important tool in controlling and reducing variation.

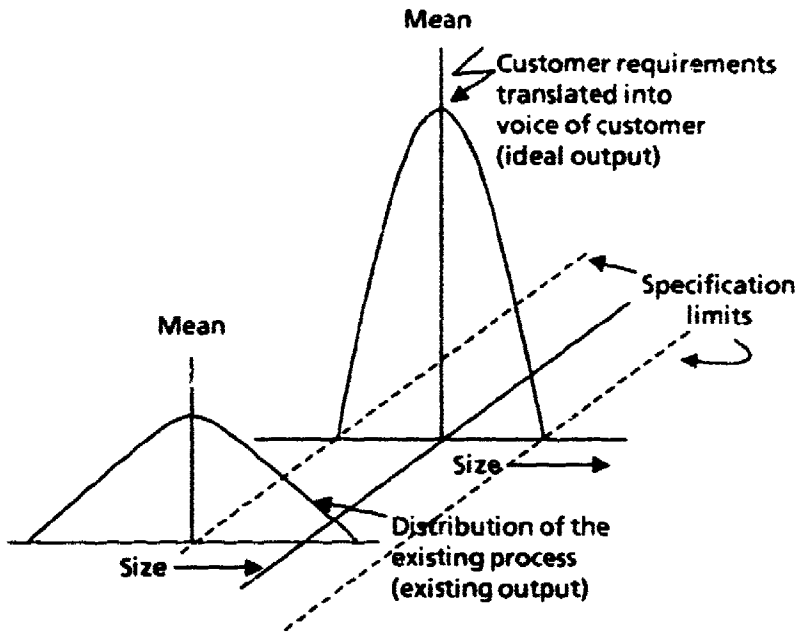


FIG. 4-22. VOICE OF THE CUSTOMER COMPARED TO EXISTING PROCESS

Another important weapon in the battle to reduce variation is the statistical control chart (Figure 4-23). That chart is a tool for monitoring process variation over time and detecting and correcting changes in process performance. It is a very powerful tool because it helps people understand as well as intelligently control their process and their work. Every individual should learn to read and use the control chart.

The concepts of variation, distribution, process capability, and process control are fundamental to continuous improvement and are part of the basic statistical knowledge base that the CIP organization attempts to provide each individual through training. These tools can be applied to reducing variation in any process and in any area of the business.

Improving product design, another major source of product performance problems, requires additional and somewhat more sophisticated techniques and tools. Among these additional tools are the Taguchi Methods for developing robust designs that are examined later in this chapter. However, one of the tools in the Taguchi Method tool kit, the loss function, bears directly on the matter of variation reduction.

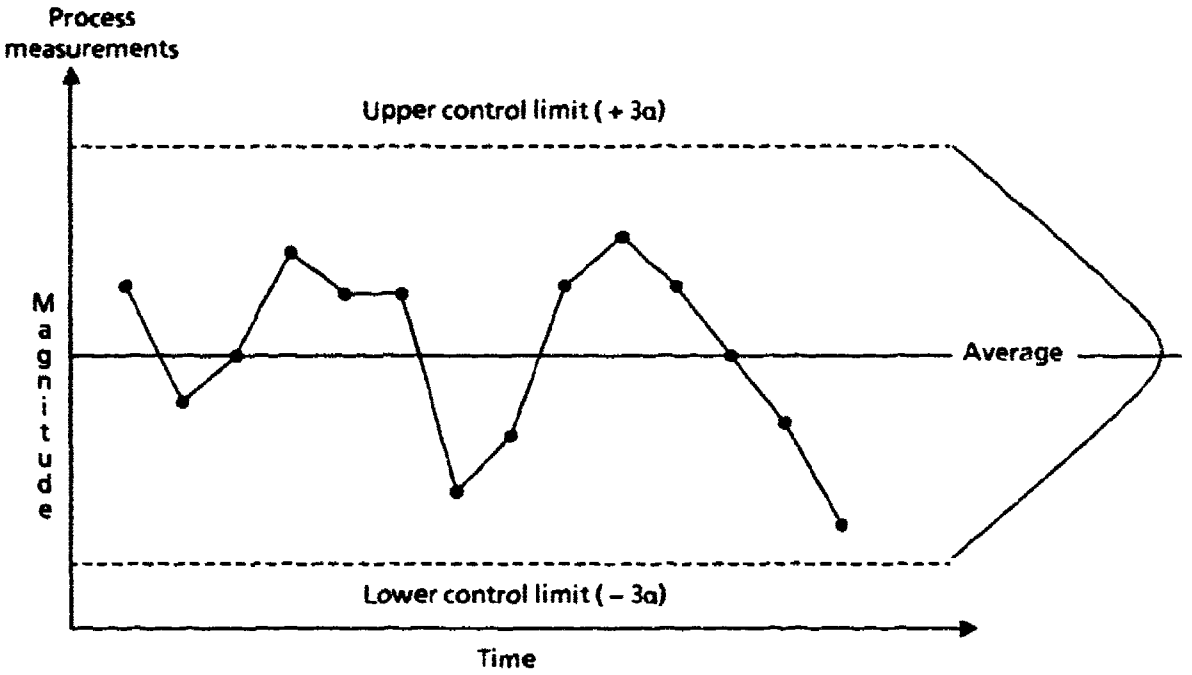


FIG. 4-23. STATISTICAL CONTROL CHART (WITH DISTRIBUTION SUPERIMPOSED)

The Taguchi loss function is basically a statement that both the producer and the customer will inevitably incur increasing costs (losses) as output variation increases around the customer's ideal requirement (voice of the customer), as shown in Figure 4-24.

The loss function reflects management's recognition that any variation from the ideal or target value for an output will create incompatibility and result in greater numbers of problems. With various techniques, the cost of such problems can be estimated and the estimated loss function can be used to quantify the value of design options, make decision making more rational, and help optimize and produce more-robust designs. Designers can use the loss function to decide how much effort and money to expend on the design to reduce variation.

The distribution, process capability, control chart, and loss function tools are but a few of the weapons available in the fight to reduce variation. When properly applied and pursued, those tools can help reduce variability and that reduction can lead directly to higher reliability, lower total cost, less waste, and higher customer satisfaction. The variability of any process in an organization can be reduced. This includes conceptual areas such as management, design engineering, and

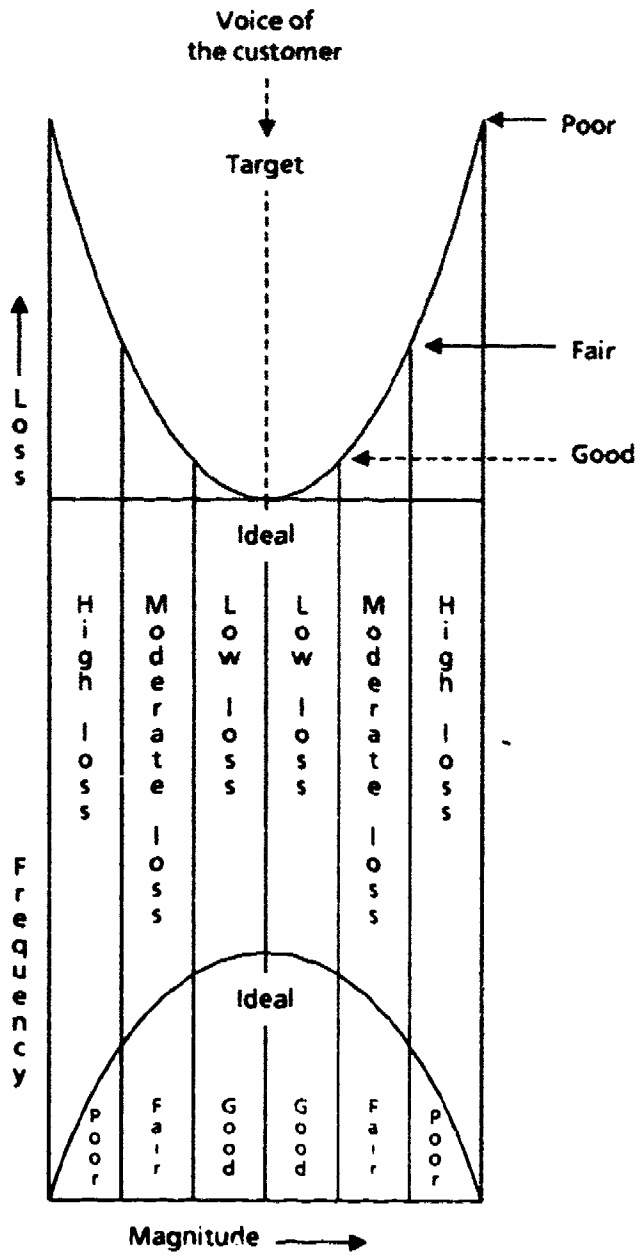


FIG. 4-24. LOSS FUNCTION

administration as well as the more traditional targets such as production and assembly.

To reduce variability, an organization must take the following actions:

- Develop a clear policy promoting variability reduction for all its processes
- Train all its people, especially its managers, in the techniques and tools for variability reduction
- Develop a performance measurement system that will permit variance in all key processes to be monitored and controlled
- Establish the means to define the "voice of the customer" and to determine, quantify, and improve process capability.

Reducing the Vendor Base

Materials and resources used as process inputs constitute a major source of variation in any process, and in many organizations, those inputs come from a vendor base outside the organization. The improving organization must understand, control, and minimize the variation in those materials and resources. Each outside vendor contributes to overall product quality by how well it controls the variability in the products it supplies. Vendors that consistently deliver input products with low variability centered on the organization's requirements are important assets, and the organization should apply the same principle of conservation of resources to such highly capable vendors as it does to its own employees.

Using multiple outside sources for a particular process input automatically increases variation even when each of the vendors is individually capable of tight control over the variation in its product. Since no two vendors deliver precisely the same product, the differences between the vendors compounds the variability problem, as illustrated in Figure 4-25.

To avoid the problem created by multiple vendors, the CIP organization strives to limit its vendor base to those with whom long-term stable business relationships exist or may develop and to use single-source procurement where possible. These procedures are counter to the common practice of using as many vendors as possible to obtain the lowest possible price. Long-term contracts, with appropriate flexibility and protection for all parties, provide greater stability and better planning and can yield higher quality and lower prices.

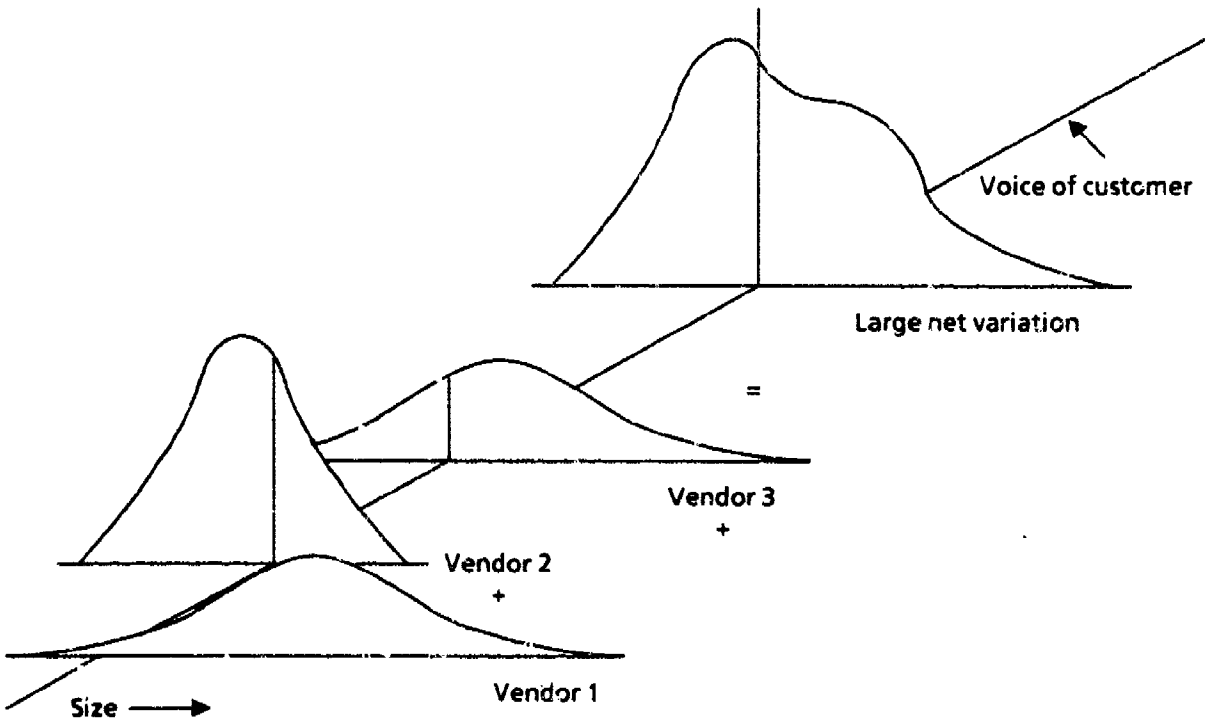


FIG. 4-25. VARIATION COMPOUNDED BY MULTIPLE VENDORS

The CIP organization carefully structures its procurement strategy to provide purchasing alternatives within the vendor base as a hedge against unforeseen disruptions. For example, consider an automobile manufacturer currently buying doors from two different vendors. A CIP procurement strategy might call for buying left side doors from one vendor and right side doors from the other. The variability in left and right doors is more tightly controlled by using single vendors for each but either vendor could quickly convert to producing both doors if a catastrophe were to happen to the other. Since the number of vendors for an item is often inversely correlated with variability and quality, using fewer vendors enables greater control over incoming quality, facilitates closer working relationships and better communication, results in lower contract administration cost, and helps facilitate improved inventory management techniques.

By reducing the vendor base, the organization can develop better working relationships with the fewer number of selected vendors and ensure the teamwork needed for continuous quality improvement in the purchased products and services. Top management must define a minimum but sufficient vendor base to maintain

competent backup sources, provide expansion capability, and ensure competitive pricing. The CIP organization works to reduce its vendor base to a set that can reliably deliver the required quantities, on time, with consistently high quality. A smaller number of suppliers facilitates better control over incoming quality, reduced acquisition costs, easier problem solving, and less incoming inspection, as well as just-in-time (JIT) delivery and smaller inventories. Vendors committed to the pursuit of continuous improvement are sought, and joint training and problem solving are encouraged.

To reduce the vendor base, an organization must take the following actions:

- Develop a strategy for reducing the number of suppliers to the minimum but sufficient quantity
- Develop a method for rating and selecting the preferred suppliers
- Establish a vendor-development process to promote and support the development of CIP practices in the supplier operations
- Involve the preferred suppliers in the internal CIP problem-solving activities in which their products or services play a part.

Preventing Defects

Preventing defects is always more cost effective than detecting and correcting them after the fact. Western managers often fail to recognize that truth because they fail to take into account the hidden internal costs of waste, scrap, and rework and the marketplace costs of producing defective products or services. Preventing defects begins with top management's commitment to improvement and its insistence on solving problems at their root causes rather than attacking symptoms.

Defect prevention applies to all forms of defects, from flaws in how systems operate and errors in data or software to physical defects in hardware. Thus, prevention is part of each person's job, especially management personnel. Management must address defect prevention through strategic planning, training, and direct hands-on personal involvement. The organization should have a clear definition of critical defects and methods for detecting, tracking, and systematically eliminating them at their source.

Defect prevention requires that everyone thoroughly understand what it means to do his/her work right the first time. Doing a task right cannot be a matter

of subjective judgment. Doing most jobs right the first time means doing them according to defined process standards. Without such standards, jobs cannot be properly taught and job performance cannot be objectively measured. A defect, in fact, is a matter of definition; that is, something recognized as a defect under today's standard may have been acceptable under yesterday's standard. Standards, therefore, are meant to constantly change so they constantly reflect improvements and new requirements.

Doing things right the first time is particularly important in regard to the introduction and deployment of a CIP culture into an organization. A poorly planned, badly executed, inadequately supported effort might not get a second chance. It might not be possible to "do it over."

Top management personnel at the Xerox Corporation spent 18 months planning an effective CIP strategy before beginning to implement it. They defined and developed many of the CIP training and support structures before they launched their cultural change process. As a result of that effective planning, they made rapid progress without significant reversals or changes in course. They did it right the first time.

An important message from nearly every pioneer organization in the realm of CIP is "plan well, start slowly, and show early success." This message has its roots in numerous false starts and lessons learned because the typical approach was one of "plan little, leap toward instant implementation, and expect big returns with no investment." The temptation to rush into CIP and expect instant results must be resisted. CIP is most successful when it is deliberate, methodical, and gradual.

To prevent defects, an organization should take the following steps:

- Develop a clear definition and understanding of what defect prevention really means and how it relates to top management, long-range business strategy, and survival of the organization
- Develop a long view of how defect prevention should unfold in the organization and a strategy for facilitating the process
- Demonstrate a commitment to defect prevention starting from the top by recognizing and addressing the management system's contribution to the production of defects

- Create a defect-detection and tracking system and a process for continuously reducing the number of defects
- Insist that identified defects be traced to their root causes and corrective actions address root causes rather than symptoms.

Managing Upstream Processes

Upstream processes are the earlier processes in an endeavor. What happens upstream significantly affects downstream (later) processes. Managing upstream processes means focusing management attention on making sound decisions and taking proper actions on very early "upstream" processes with the specific intent of avoiding problems and minimizing changes in the downstream or follow-on processes. For example, upstream management requires that early product concept and design decisions take manufacturing into account to avoid re-engineering the product because of unforeseen production constraints. Upstream process management strategies call for greater understanding and communication across disciplines and greater collaboration in early decision making.

Early communication and coordination by the members of the product development team can help identify potential problems and find early solutions to ensure a better linkage between the product concept and the voice of the customer. The difficulty and cost of bridging gaps between the product and the customer's requirements increases exponentially as the product moves downstream, as illustrated in Figure 4-26.

The CIP organization seeks to minimize downstream problems, disruptions, and product changes by intensive management of upstream processes and decisions. Service and manufacturing concerns are addressed very early in the design processes. Design of experiments and other techniques are used to select the best materials, determine the best configurations, minimize performance variations, and arrive at the best designs before substantial time and downstream resources have been committed. Quality function deployment (QFD), Taguchi Method, and capability analysis are among the techniques employed to achieve upstream management. These topics are discussed under "Support of Commitment to Quality," the next major section of this chapter.

Upstream management requires deliberate management attention and coordination. It generally involves breaking down traditional barriers and building

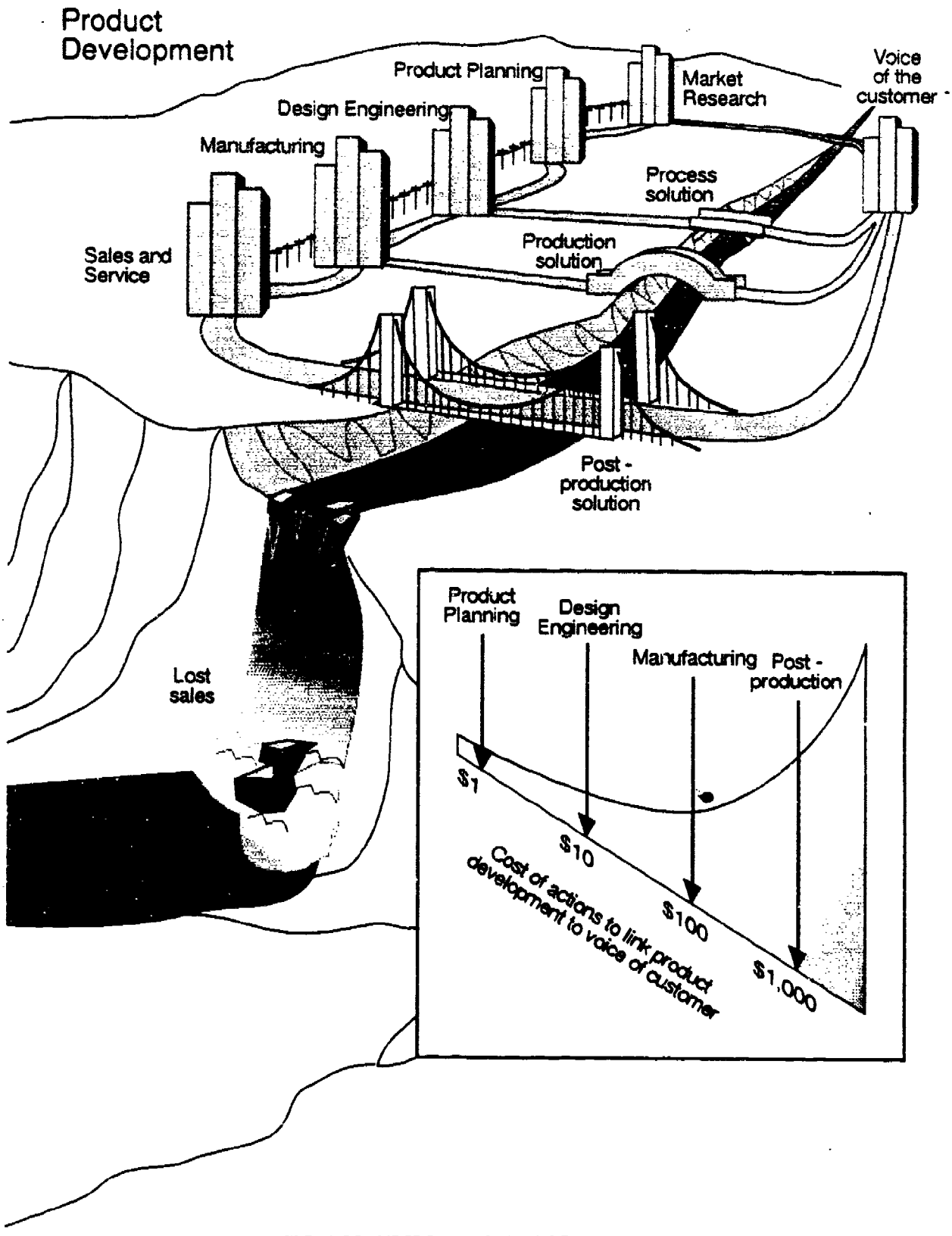


FIG. 4-26. UPSTREAM MANAGEMENT

new channels of communication between organizations that rarely communicate. For some organizations it may be necessary to mediate hostility and resentment over having one group "meddle" in the prerogatives of the other. Upstream management generally requires establishing cross-functional teams at all levels to negotiate, employ joint decision-making techniques, and resolve cross-functional issues.

Top management must make its commitment to upstream management abundantly clear in its policies, strategic planning, decisions, and action. Training in techniques central to upstream management and appropriate for the organization such as group dynamics, negotiation, QFD, design of experiments, and concurrent engineering should be available and be mandatory for those engaged in cross-functional engineering team activity.

The organization should have an assessment capability to ensure that upstream management is vigorous and healthy and to track the performance of cross-functional activity. It should also have a feedback process to indicate whether the upstream decisions and actions are having the desired downstream effects.

To manage upstream processes, an organization must take the following actions:

- Develop a clear policy with respect to upstream management, establishment of cross-functional communications, and integration of downstream considerations in upstream decision making
- Provide training in the principles, practices, techniques, and tools that are essential for effective upstream management
- Develop a capability to track the performance of the upstream management processes as well as provide feedback on the effectiveness of upstream decisions and actions in reducing downstream issues.

SUPPORT OF COMMITMENT TO QUALITY

Commitment to quality is a cornerstone of continuous improvement. Quality is the sum of the impressions that influence a customer's judgment and decisions about a product or service. Thus, a commitment to quality is first and foremost a commitment to customer service and satisfaction. Quality improvement requires increasing customer perceptions of excellence with respect to such factors as

reliability, maintainability, cost, performance, schedule, responsiveness, and comparison with available competitive alternatives.

A commitment to quality means more than simply complying with specifications. It requires serious study of both internal and external processes to understand their influence on and contribution to quality and then constantly improving those processes to foster positive change in the organization's products and services. Deliberate change, targeted to produce desired customer response behavior, begins with top management and extends to every area and activity to systematically eliminate scrap, rework, and waste and to require the minimum of inventory, time, and cost.

Deploying Quality

Quality deployment is a process for ensuring that quality is designed into products and services in an efficient and effective manner. QFD, developed in Japan, is a proven technique for meeting this objective. It helps organizations design higher quality, more competitive, lower cost products easier and faster and is aimed primarily at the development of new products. It starts early in new product design efforts and translates customer requirements into design and product characteristics, communicating them in a structured way to influence upstream design decisions and actions. Traditional design organizations have focused more on meeting specifications or technical requirements than on satisfying customer expectations. QFD links customer expectations to the technical considerations of the designer and manufacturer, and to the concept of value in a manner that connections and relationships can be understood and addressed.

Quality function deployment helps ensure quality products and processes by detecting and solving problems early. Downstream problems may occur and product quality may suffer when those who work on components and parts have little knowledge of customer requirements or the specifics of the final product and manufacturing processes. The QFD process forces the management to analyze broad customer needs and expectations (such as ease of use or comfort) and relate them directly to such product characteristics as weight, strength, speed, and temperature. Those characteristics in turn are related to the processes involved in achieving the technical requirements. Specific techniques and tools are employed in the course of

QFD. One of the principal QFD tools is the "house of quality" matrix shown in Figure 4-27.

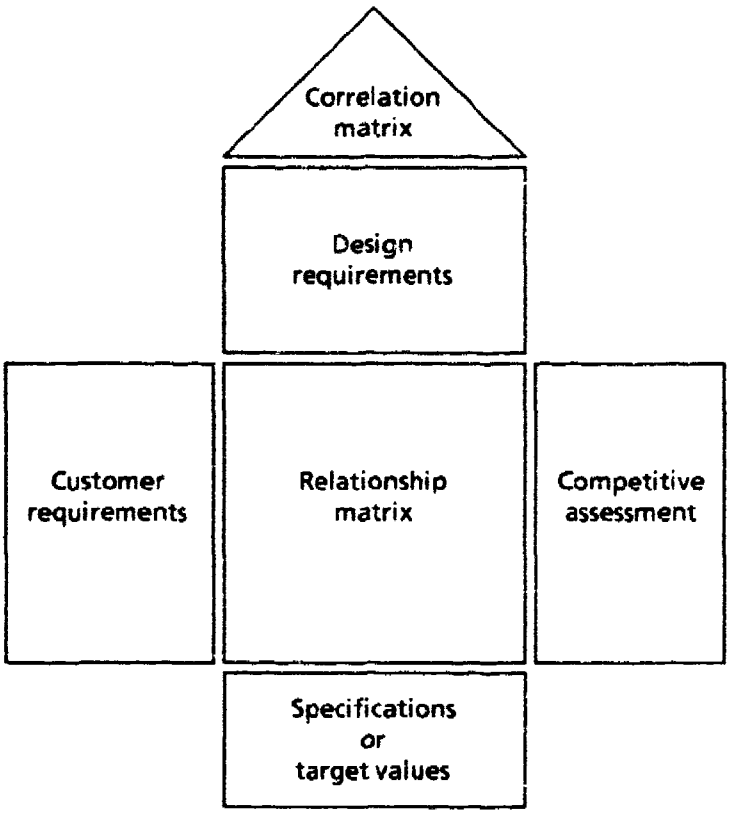


FIG. 4-27. HOUSE OF QUALITY MATRIX

The matrix identifies specific customer-required characteristics, assigns priorities to them, and converts them to product attributes and design characteristics through cross-functional team activity. The matrix relates customer needs and expectations to specific product characteristics such as thickness, strength, and weight and links those characteristics to the product-related functional area processes. It communicates product-specific requirements, standards, and specifications in a coordinated and consistent way across all the functions that have responsibilities affecting the product. The generation and distribution of quality matrices force early identification of conflicting objectives and potential bottlenecks. Early cross-functional communication should be centered on quality – resolving many potential problems before major investments of time and money have been made.

Another application of QFD is in policy management, a process through which top management evaluates the interaction of organizational objectives with the means of achievement. Policy management is also achieved through analysis and the employment of matrices similar to the one shown in Figure 4-28.

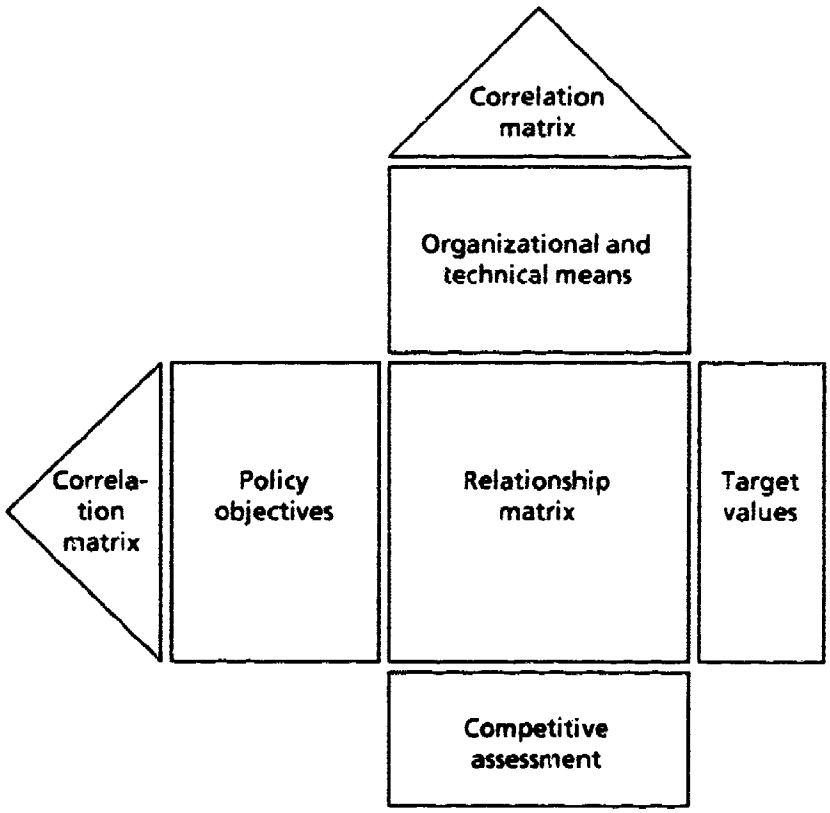


FIG. 4-28. POLICY ASSESSMENT MATRIX

Quality function deployment policy management requires management to go beyond setting objectives and measuring results. It requires management to focus on the means of achieving policy, taking specific interest in the methods, processes, and resources involved or required. QFD policy management then is a structured business-planning activity and part of the means of achieving policy objectives.

Using QFD requires more management time and effort early in the product development and business-planning processes but reduces total development and plan execution time dramatically because priorities and problems are addressed early, relationships are defined and established, and communication and documentation are improved.

To deploy quality, an organization should take the following actions:

- Develop a clear quality-deployment policy especially for new product development and business planning
- Provide training in quality deployment and ensure that all personnel understand and effectively employ the techniques and tools
- Require its managers to become actively involved in the quality-deployment process, facilitate cross-functional communication, and vigorously work to remove roadblocks and resolve problems quickly
- Make deploying quality into its products, services, and processes a high priority.

Developing Robust Designs

A robust design is one that is strong and healthy and capable of properly performing its function under a wide range of conditions, including customer misuse. Robust designs are less sensitive to variation in parts, processes, and operating environments. By carefully selecting design parameters, an organization can produce products that are more forgiving and tolerant. More robust designs result in higher customer satisfaction, lower production and support costs, and greater production flexibility. Basically, they are easier to manufacture correctly. The development of more robust designs is practiced as a key element of CIP. This is one of the principal thrusts of the methods developed by Taguchi.

Taguchi, a Japanese engineer and management consultant, developed his techniques of product and process development to optimize designs by minimizing loss (cost), improving consistency of performance, and creating robust products. The Taguchi Methods include a technique for estimating the loss associated with controlling or failing to control process variability.

Traditional approaches to design and production stress compliance with specifications. The ideal "target" value that will translate into the most robust product and produce the highest customer satisfaction should be some fixed value within the specification limits. However, as long as products fall within the specification limits, as illustrated by Points a and b in Figure 4-29, they are considered equally good. If a product falls outside the limits, as is Point c, it is automatically bad.

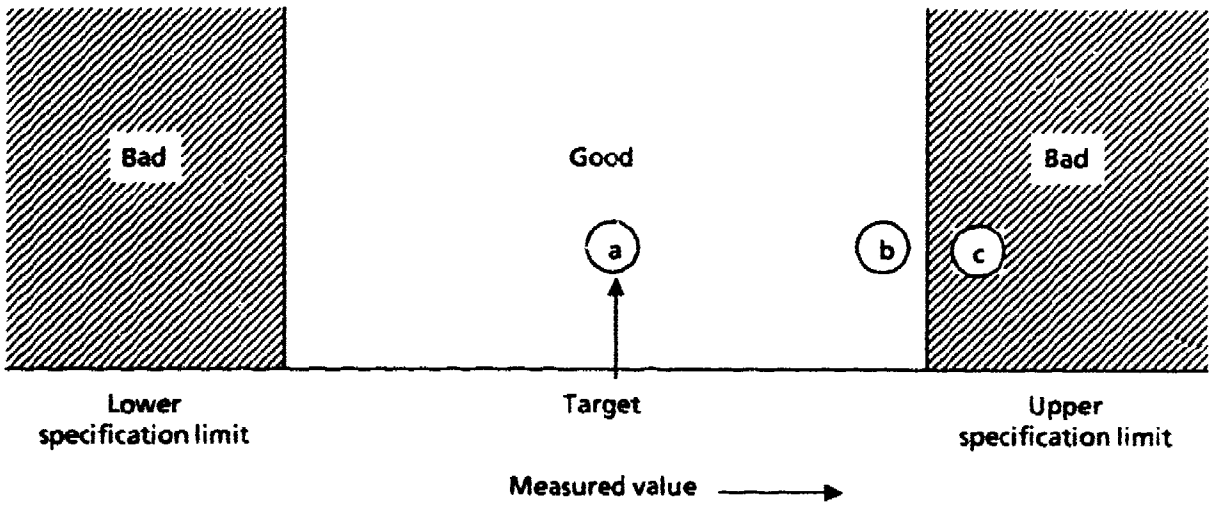


FIG. 4-29. ANY PRODUCT IN SPECIFICATION IS GOOD (OLD THINKING)

Observation and common sense reveal that the difference between the "bad" c and the "good" b can be slight and the distinction between them is somewhat arbitrary. Likewise, the difference between a and b makes it clear that they are not equal and b, the farthest from the target value, must be in some sense less "good."

The Taguchi Method uses statistical techniques to compute a "loss function," as illustrated in Figure 4-30, that can be used to determine the cost of producing products that fail to achieve a target value. The tool is also useful for determining the value or break-even point of improving a process to reduce variability.

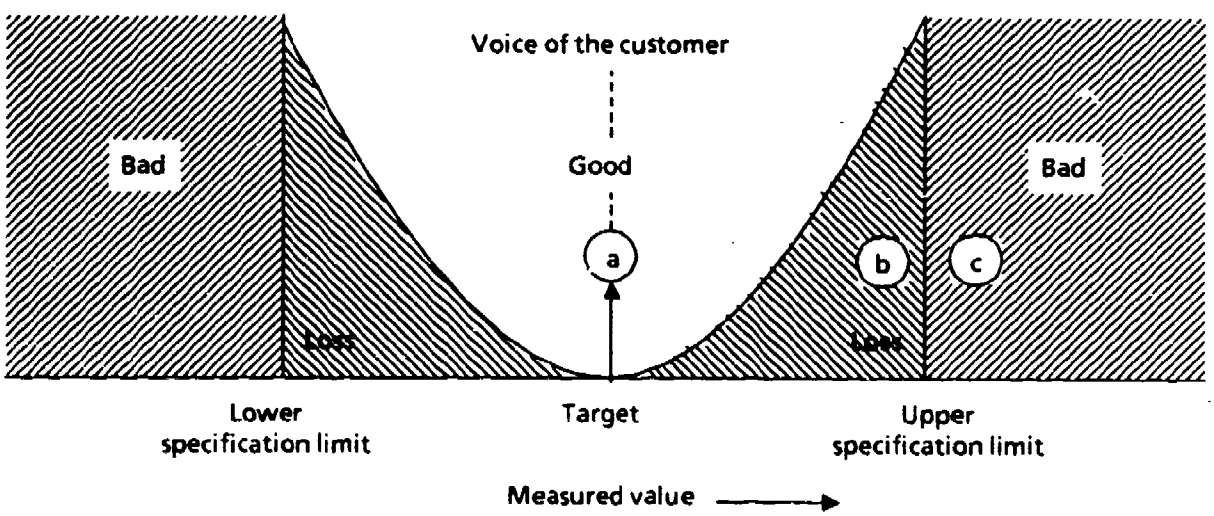


FIG. 4-30. DEVIATION FROM THE TARGET CREATES LOSS (NEW THINKING)

If the target value is indeed an ideal value, product performance will degrade as a function of any deviation from the target. An increasing cost is associated with products farther from the target. For example, the cost may be lower reliability, higher warranty, less accurate performance, or less tolerance of the environments in which they are used. Either the customer or the producer may directly bear the increased cost but ultimately both will be hurt. A dissatisfied customer may choose not to be a repeat customer.

The Taguchi loss function is a way to show the economic importance of reducing variation. While QFD is a process to ensure that customer requirements are understood and translated into technical requirements, the loss function is a method to quantify the cost of failing to meet those requirements.

Several different engineering techniques for producing more robust designs are included in the Taguchi Methods. Another technique of the Taguchi Method designs experiments for investigating the effects and interactions among selected design parameters. The technique permits engineers to choose among design alternatives on the basis of a minimum number of controlled tests. These carefully designed experiments permit engineers to select the optimum combination of materials, components, and tolerances to satisfy customer requirements. Through the scientific design of experiments, the organization can design for optimum robustness quickly and with less cost.

Developing more robust designs is not an excuse for paying less attention to improving processes elsewhere in the system. Efforts to reduce variability must continue across all process areas and for all incoming materials. It is the combination of more robust design and lower variability of inputs with improved processes that yields the most competitive product.

To develop robust designs, an organization must take the following actions:

- Develop a clear policy of designing robust products and making production of robust products, services, and processes a high priority
- Stress early application of advanced engineering techniques and tools in new product development and business planning
- Provide training in advanced design development techniques such as the Taguchi Methods

- Ensure that all personnel understand and effectively employ the techniques and tools that produce robust designs
- Require managers to become actively involved in the design development process, employ statistical methods like the "loss function," facilitate design experiments, and vigorously work to remove design process roadblocks.

Improving Production Flow and Reducing Inventory

A healthy organization, like a healthy body, requires a vigorous flow of its life-blood. For the body, the heart rate, blood pressure, and arterial pathways are indicators of circulation health. Similar indicators for an organization might include production flow rate, work backlog, bottlenecks, and inventory performance. Excessive inventory levels, slow inventory turnover rates, long leadtimes, and long production cycle times can have serious adverse effects on quality and customer satisfaction.

Poorly designed and managed production flows create problems. Production cannot be properly coordinated, for example, when the distance between processes is too long. Long flow times make it nearly impossible to reconstruct cause and effect when problems are detected. Many techniques are available for improving the design of production systems for better flow and inventory management. Among them are JIT process management; *Kanban* material control; cellular processing; one-stop, all-stop flow control (OAFC); and leadtime reduction. Each of those techniques is described briefly here.

Just-In-Time Technique

Just-in-time, refined by Toyota in Japan in the 1960s, is a technique to manage resources, requirements, and production such that the right materiel arrives at the right place at the right time, just in time for use. JIT requires managers to design their systems to operate as continuous-flow processes to the maximum extent possible. That operation requires better planning, communication, and coordination but operates with lower inventories and yields higher quality and more-efficient operation.

The JIT concept requires a significant change in thinking for most production managers. Traditional production processes are push systems in that they operate continuously for maximum productivity and push their completed work to the next stage of production or into excess inventory storage. A JIT system is a pull system

regulated by the requirements of downstream processes. Material is produced only in sufficient quantity to satisfy current demand and fill a small buffer stock held in a space designed to accommodate it. The production process is managed to avoid producing quantities in excess of those that can be accommodated by the downstream processes.

To ensure that material arrives at a production stage only when that stage is prepared to use it, material is pulled by downstream process demand from the designated holding area of the previous stage. This creates space in the designated buffer holding area and signals the requirement to produce another item or batch. This concept applies to the relationships between individual process stages and between an organization and its suppliers. Production and flow rates are carefully planned and coordinated such that production and delivery are regulated by the demand of the downstream processes.

Just-in-time also allows an organization to reduce its preproduction inventory. Excessive inventory creates or hides numerous problems, ties up needed capital, consumes valuable space, becomes obsolete, may become a hazard, and generates unnecessary inventory management cost. By deliberately and methodically reducing inventory, the CIP organization seeks to expose and eliminate bottlenecks, reduce costs, make more efficient use of space, avoid the need for complex inventory management systems, enhance safety, and improve quality.

Kanban Material Control

Another technique for improving process flow is *Kanban*, a Japanese word meaning tag, signboard, or label. The *Kanban* technique for controlling the flow of material employs tags, status display boards, small designated material transfer spaces, dedicated containers, and similar mechanisms to give better visibility and control to the flow of material.

In a *Kanban* system such as shown in Figure 4-31, material arrives in a dedicated container that is positioned in a designated space. The container has a multipurpose card attached that identifies the material, supports inventory tracking, and also serves as a communication device to trigger a reorder when the material is consumed. The dedicated space is configured to limit the quantity of material that may be held to that calculated as appropriate for JIT processing. When material is removed from the designated container for processing, the *Kanban*

tag or card is sent back to the supplier or entered into an electronic ordering system to signal a demand for another production lot or item. The dedicated container is cycled back to its origin for reuse. The limited number of dedicated containers also serves as a control or regulator on the rate of production. These mechanisms reinforce the JIT demand-based or pull system for material flow.

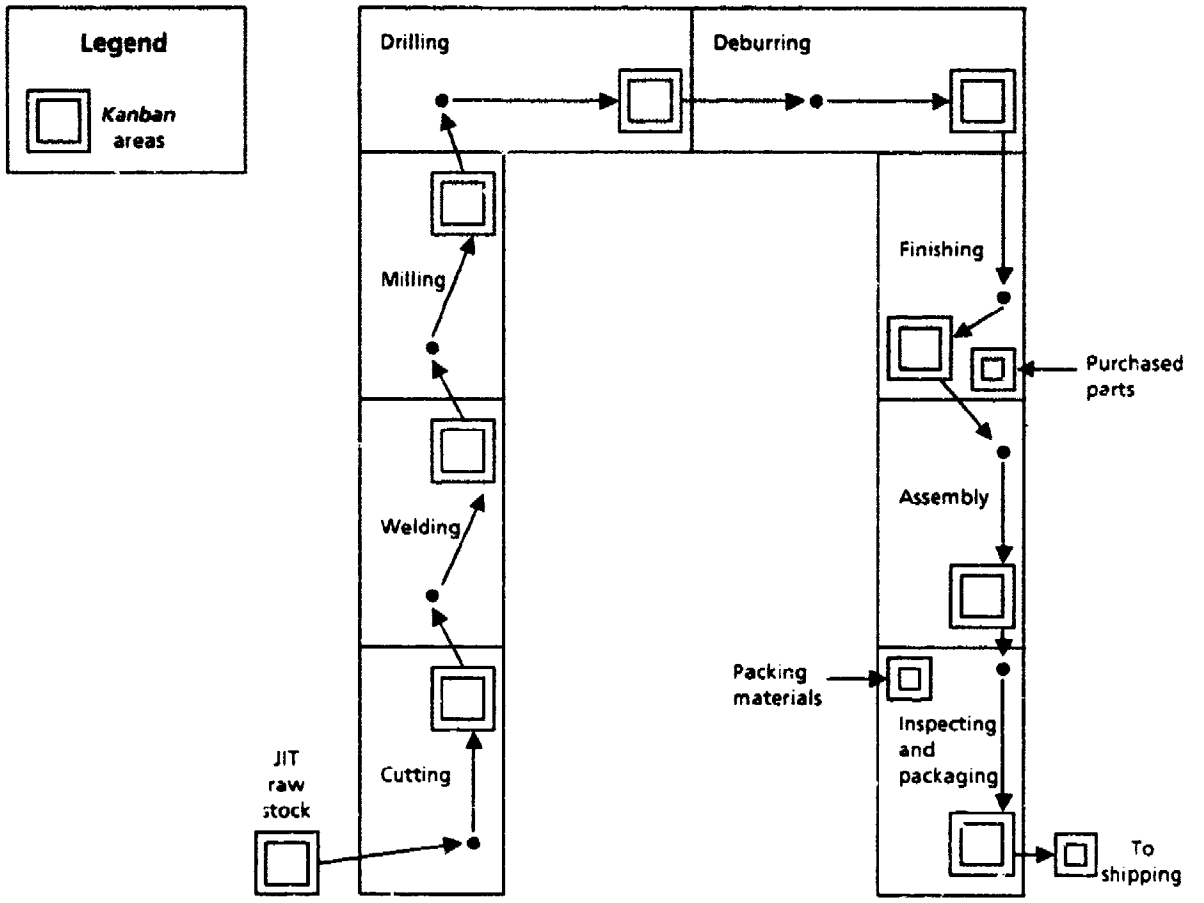


FIG. 4-31. DESIGNATED *KANBAN* AREAS

Kanban visibility boards, such as that shown in Figure 4-32, are prominently displayed in key spaces in the production area to show material inventory status at a glance. The board uses colored tags to show the quantity, location, and stage of processing for each unit of material in the processing area. The system is simple, accurate, and under the management control and responsibility of the production area team.

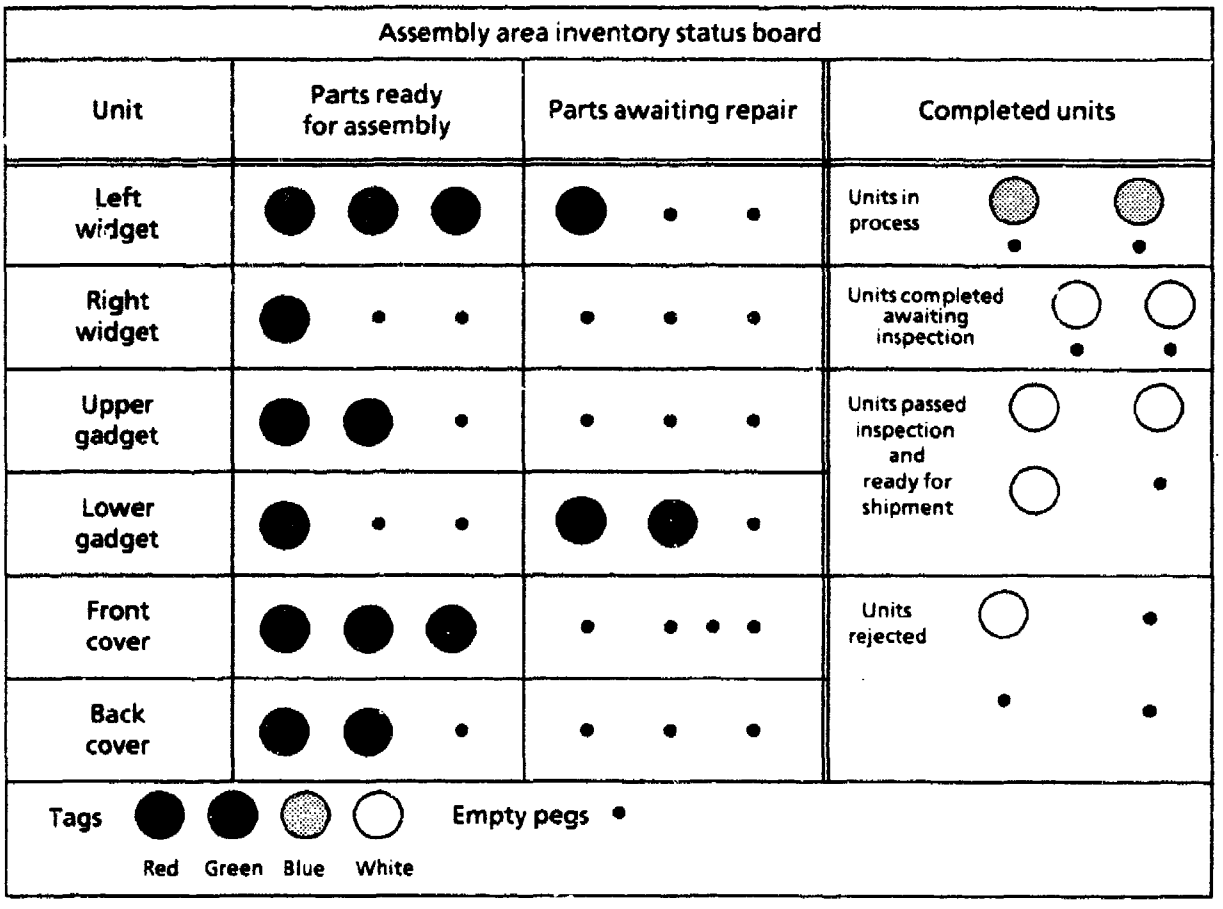


FIG. 4-32. *KANBAN* VISIBILITY BOARD

Cellular Processing

Cellular processing is a technique for designing, grouping, and managing production operations as self-contained flexible cells capable of start-to-finish processing of a family of items as illustrated in Figure 4-33. The word synergy describes well the relationship between cellular processing and other CIP techniques such as JIT, *Kanban*, team development, generalization, and statistical process control.

A cellular processing family is comprised of items that all flow through a similar path of process stages. Such a family may contain numerous very different items; their only similarity being the process steps involved. For example, automobile brake shoes, though following similar process steps, may have many different sizes and configurations.

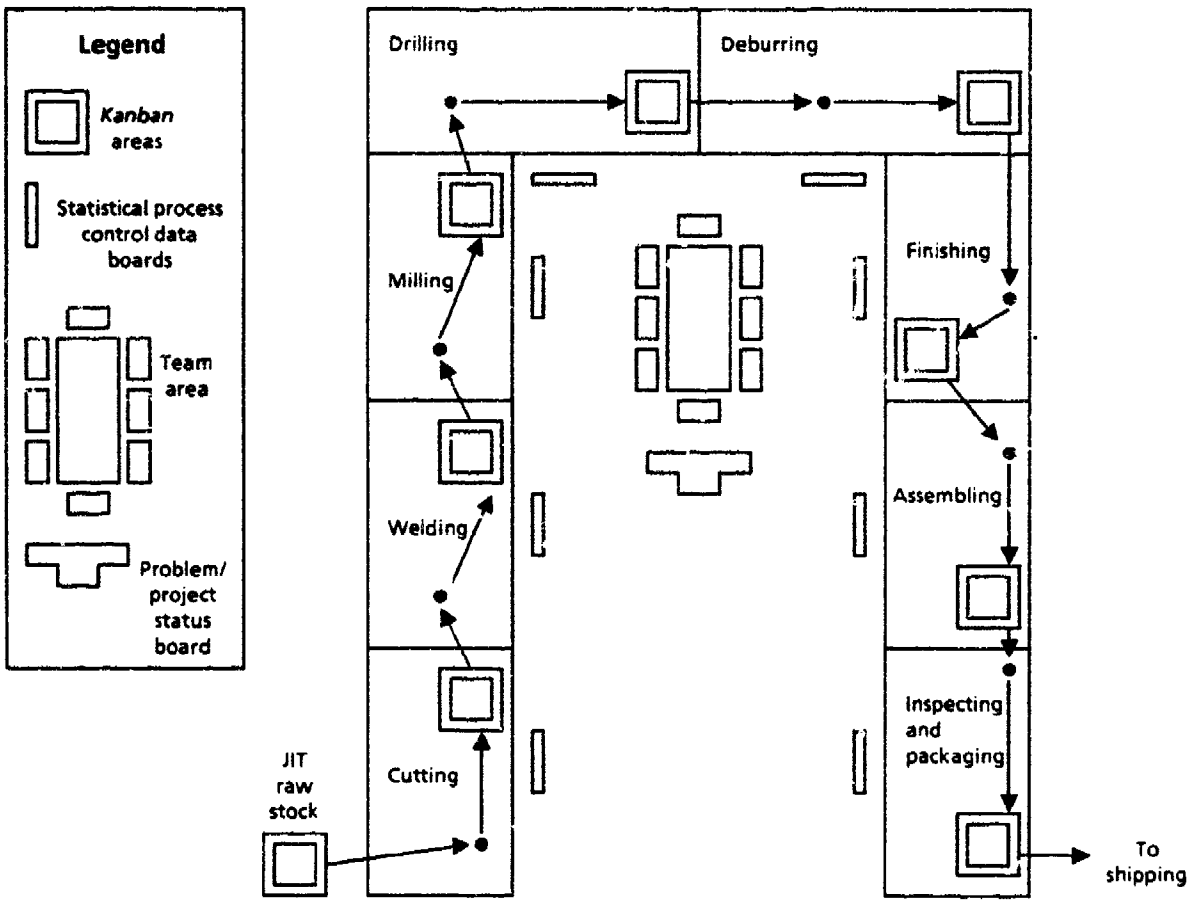
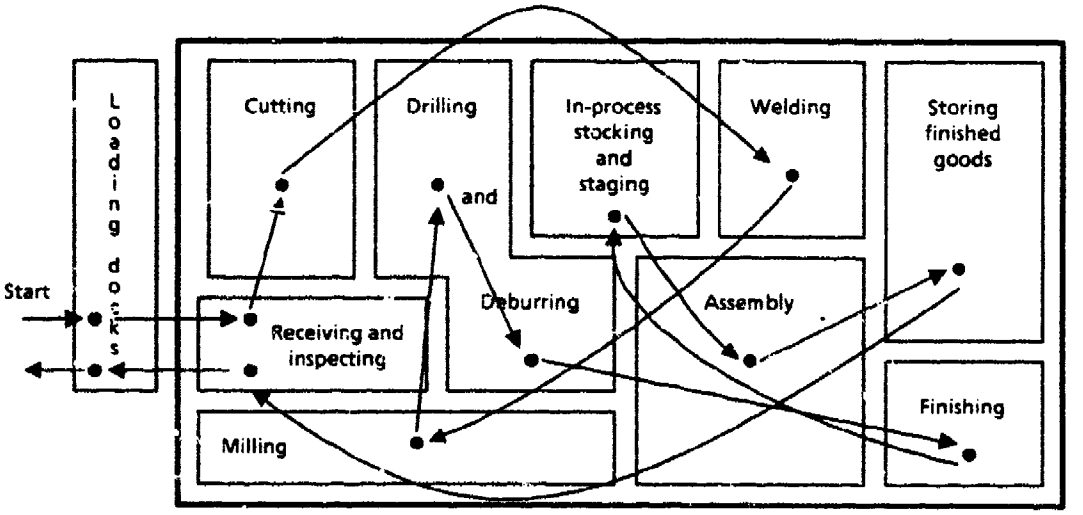


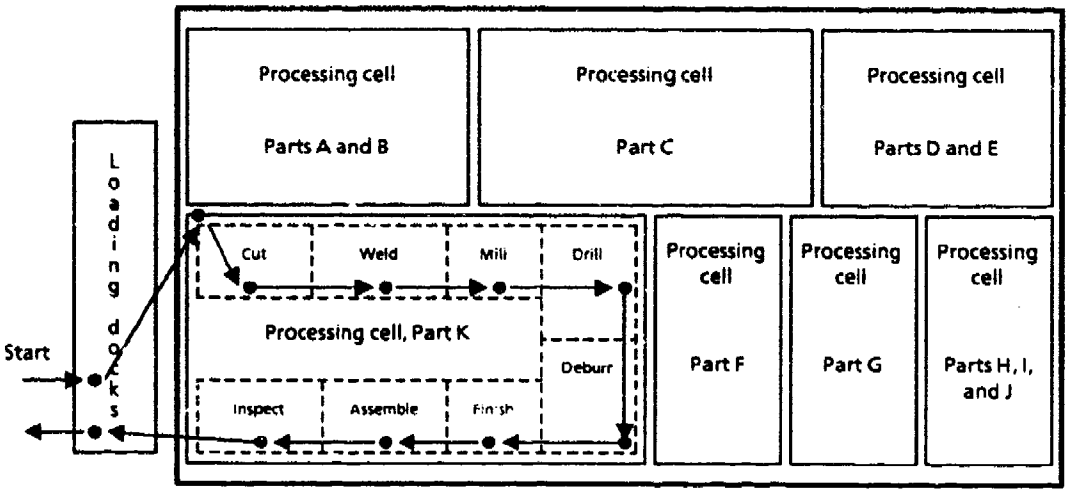
FIG. 4-33. PROCESSING CELL

Principles of industrial engineering and efficient layout are applied in designing processing cells. A processing cell is configured to operate as a flow process as much as possible. Equipment or stages are organized to minimize the distance processed items must travel as illustrated in Figure 4-34. Simple techniques are employed to move items from one station to the next. JIT and *Kanban* principles are typically applied to cell operations so that storage space, racks, and inventory are minimized.

The traditional functionally organized production operation tends to fragment responsibility for quality because no individual manager has direct oversight of processing items from raw inputs to finished products. No one is in charge! Cellular processing creates centers within which a single person is responsible for start-to-finish management including scheduling, quality improvement, worker skill development, problem solving, and roadblock removal. The team that operates a



Old functional process layout



New cellular process layout

FIG. 4-34. CELLULAR PROCESS LAYOUT REDUCES MATERIAL MOVEMENT

processing cell is likely to comprise generalists who can operate any piece of equipment in the cell. That composition increases flexibility and may reduce the process personnel requirements.

One-Stop, All-Stop Flow Control

Coordination and communication among process stages is crucial in maintaining a balanced flow process. OAFC regulates a process as a traffic light regulates automobile traffic. Lights or signals strategically placed throughout the

process or facility communicate the status of the system. This technique is frequently used in conjunction with cellular processing, JIT, and *Kanban* techniques.

The OAFC technique results in all stages of a process functioning together as a unit, as shown in Figure 4-35. If one stage of the process has a major problem and must shut down for correction, all other stages of the process will automatically stop after reaching a predetermined quantity of completed work in its holding area. This technique prevents the production of excess inventory and keeps the production flow balanced. This is especially important if the downstream problem is caused by defective material from an upstream process. When all processes stop until the problem is corrected, the amount of defective material produced can be kept to a minimum regardless of where the root cause resides in the system.

The OAFC generally employs simple signaling devices such as green, yellow, and red lights to communicate system status. A green light signals an all-systems-go status. A yellow light indicates a minor problem in the system and that production in the unaffected stages should continue up to their designated level. A red light means all processes stop with local variations such as completing current work in process. The rules of an OAFC system permit anyone to stop the process if he/she suspects or detects a problem. Stopping the process to correct a problem is considered a positive action and is encouraged by management even when the action turns out to be minor or a false alarm.

In advanced production flow control systems such as found on Toyota's production lines, machines are equipped with automatic stop mechanisms to shut down entire processes automatically whenever a defect is detected. In such a system a worker is not required to attend each automated machine; therefore, one worker may be responsible for many machines. In both the manual and automated flow control environments, supervisors and selected process-improvement-team members converge on the problem area immediately and correct the problem as quickly as possible. If outside help is required, it is dispatched rapidly to the problem area. Higher levels of management serve to facilitate and expedite corrective action when solutions require actions beyond the authority of the local teams.

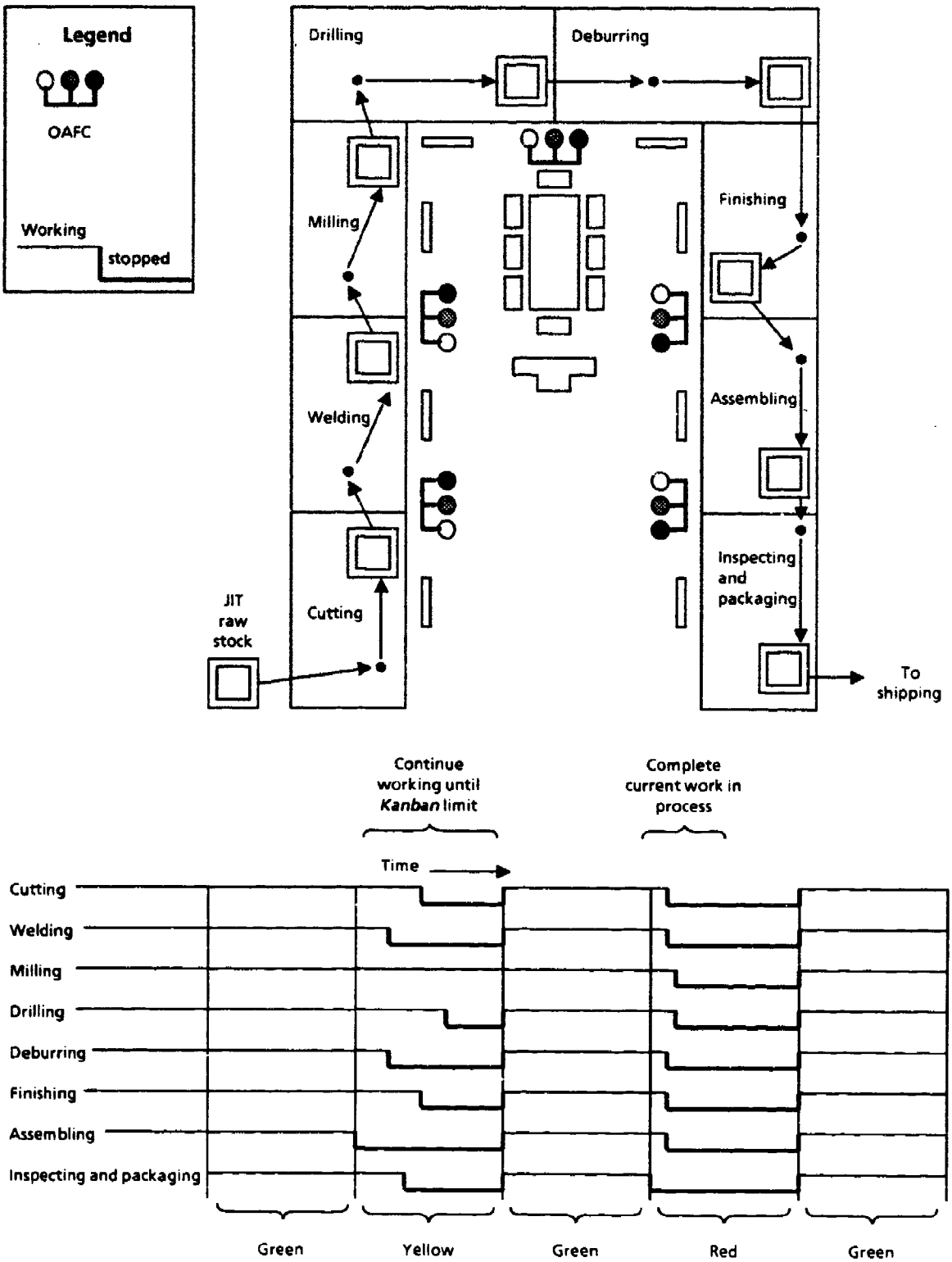


FIG. 4-35. ONE-STOP, ALL-STOP FLOW CONTROL

People are not idle while a process is down. Those not engaged in problem analysis and correction may engage in improvement activity, housekeeping, preventive maintenance, training, or similar productive endeavors. Traditional managers often find it difficult to accept stopping an entire process when only a part of the process is broken. They tend to view machines or process stages as independent islands of production to be operated at maximum capacity in order to maximize productivity. Enlightened managers, however, understand that the productivity of a process is limited by the capacity of its weakest link. Production beyond that capacity simply creates excess work-in-process inventory. The key to maximum productivity is to maintain a balanced process flow, paying particular attention to rapid correction of problems and improving the weakest links (i.e., bottlenecks).

Leadtime Reduction

Leadtime, or production cycle time, is an important indicator of production flow vitality. Cycle time reduction is a primary objective of CIP organizations. Long cycle times are caused by numerous sources of delay, including slow or error-prone order entry, inefficient information processing, inadequate specifications, poor design practices, long set-up times, unreliable equipment, poorly trained people, lack of coordination, poor planning, and inadequate coordination. The list is endless. But by solving the problems that cause these delays, cycle time is systematically reduced and therefore serves as an excellent indicator of overall improvement in the system.

Performance measurement for production cells generally includes prominently displayed leadtime or cycle time tracking charts. These charts reflect the average cycle time for the family of items processed and the trend over an extended period. Associated with a chart may also be a list of improvements to production cell processes, problems encountered and solved, critical procedures, and management praise or recognition.

To improve production flow and reduce inventory, an organization must take the following actions:

- Develop a clear policy dealing with production flow and inventory management

- Provide training in production flow improvement and inventory reduction techniques such as JIT, *Kanban*, cellular processing, OAFC, and leadtime reduction
- Ensure that management signals and actions are consistent with maintaining balanced process flows and optimum inventory levels
- Recognize the synergy of the various process flow and inventory management techniques and devise a comprehensive strategy for their implementation and integration
- Involve suppliers in the plan to improve process flows and reduce inventories
- Establish meaningful measurement systems to accurately reflect process flow and inventory performance and improvement
- Provide healthy communication, feedback, reward, and recognition to stimulate individual and team initiatives for process flow and inventory improvement.

SUPPORT OF SYSTEM-CENTERED MANAGEMENT

System-centered management requires managers to reform the processes by which work is accomplished. Managers must work on the system to improve it while they are working in the system to carry out their functional responsibilities. The system-centered manager recognizes that signals, communication, and feedback are as important as tangible mechanical processes and that achieving optimum system performance requires integrating technical approaches with social approaches.

System-centered managers know that individual techniques such as statistical process control, JIT, or automation are merely the tools of improvement and do not in themselves constitute the improvements. These managers embrace a larger perspective and consider how system elements, problems, and possible solutions all interact. They consider means as well as ends, see the synergy of system elements, and take a global view of processes. They seek to understand and simplify existing processes, encourage subordinates to identify problems, work with those subordinates to solve problems, help them grow intellectually, and instruct them in methods of process improvement. Among the most important practices of system-centered managers are developing responsibility and authority, removing sociostructural barriers, and removing roadblocks and bottlenecks.

Developing Responsibility and Authority

Responsibility and authority are essential ingredients of continuous improvement. They must go hand-in-hand; one without the other is meaningless. Yet many traditional management systems imply responsibility while they deny authority. The result is that no one is accountable. Even when problems are clearly recognized, they go unaddressed because the "its-not-my-job" attitude is pervasive. Each individual must recognize his/her responsibility for job performance and improvement.

Developing process ownership through team development and process definition is a major factor in creating real accountability. As process-improvement teams are formed, upper levels of management must deliberately relinquish some control and transfer responsibility and authority to the process owners. That transfer is one of the most difficult changes in CIP because middle managers often feel threatened by their perceived loss of control. That middle management perception is why top-down implementation of CIP is so important. Top management must start the process of moving responsibility and authority deeper into the organization, simultaneously giving middle managers new accountability while asking them to give up old responsibility and authority. Top management must also send the signals and create an environment that make the change process as nonthreatening as possible.

Another important element in establishing meaningful responsibility and accountability is clear, well defined, and measurable performance criteria for each job. Such criteria flow directly from the structure and discipline of performance improvement activity such as customer requirements definition, process definition, standardization, and measurement system development. An individual who knows precisely what is required to do the job right and has an unambiguous performance measurement system that permits effective control of the process can accept accountability in a logical, natural, and comfortable manner.

Everyone is responsible for continuous improvement; it does not reside in a staff function. A small CIP facilitation staff at a high level in the organization should be established to support training, creation of process-improvement teams, and implementation of the improvement process in the line organization functions. However, the responsibility and authority for employing the process and

implementing changes for improvement belongs to line management. The objective of the CIP facilitation staff should be to ultimately work itself out of a job. The objective of each line manager should be to define each process and develop each subordinate such that appropriate responsibility and authority are integral to every job. Ultimately, the "its-not-my-job" attitude should have no legitimate home in the organization.

Each individual should be held accountable for the quality of his products and services and for employing the improvement process to foster continuous constructive change. All CIP organization processes, both line and staff, are subject to improvement including planning, finance, quality assurance, quality control, research and engineering, administration, and manufacturing and marketing. Management should carefully examine the alignment of responsibility and authority in each of these areas and deliberately deploy them to the lowest logical level.

To develop line responsibility and authority, an organization must take the following steps:

- Develop a clear statement of every manager's responsibility and authority for implementing and employing CIP
- Examine the alignment of responsibility and accountability throughout the organization and continuously foster improvements in it
- Create a training program that addresses responsibility and authority, their relationship to improvement, and their proper assignment with respect to processes and jobs
- Employ process control and measurement systems that enable individuals to influence performance and results commensurate with their accountability
- Provide a communication and feedback mechanism sensitive to the concerns of middle managers and the needs of subordinates as responsibility and accountability are deployed lower into the organization
- Devise a reward and recognition system that clearly conveys the accountability of every manager to demonstrate CIP-compatible behavior and to continuously improve processes, products, and services

- Develop a mechanism for identifying and removing any roadblocks that could prevent a manager from recognizing or exercising his CIP responsibility and authority.

Removing Sociocultural Barriers

Sociocultural barriers are real or perceived inhibitors of communication, association, or equality among groups. Examples of such barriers are separate dining facilities, parking accommodations, access to information, or management-union friction. Those barriers are obvious; others are more subtle, such as worker fear of management, engineering disdain of manufacturing, or white-collar elitism regarding blue-collar work. Each overt or subtle barrier makes improvement more difficult.

The CIP organization examines itself to identify and eliminate sociocultural barriers. It seeks greater integration of management with labor and amalgamation of upstream with downstream technical functions. Symbols of status such as privileged parking spaces, differential office spaces, or status-conveying uniforms and titles are eliminated or minimized.

Organizational entities and work groups are all treated by top management as equally important and essential to the healthy functioning of the corporate body. All groups are given greater responsibility for self-supervision, and managers at all levels make greater effort to be available, to be seen, and to be interested. Communication barriers are lowered by collocating functions such as engineering and production. Emphasis is placed on generalization and cross-training such that skill and job distinctions are diminished. The organization is made more homogeneous as barriers to communication are removed.

Walking around and becoming aware of the voice of the work force becomes a standard management practice. "Management by walking around" is condoned and encouraged by top management. Commitment is communicated by involvement. By doing and saying the right things and asking the right questions, management can systematically lower sociocultural communication barriers and convince subordinates that the organization is serious about improvement. The management-by-walking-around process strengthens the commitment of managers and deepens their understanding of the processes they own.

All managers, including those at the very highest levels, make their personal visibility and availability a priority. Time is allocated on a regular basis, even in the busiest schedules, to learning about how things are going. No opportunity is lost to inject improvement messages into speeches, reports, conversations, meetings, or correspondence. While this amount of emphasis may seem excessive to some, it must be appreciated that cultural change is not easily accomplished. The time and effort spent to provide more visibility, improve communication, and lower sociocultural barriers will be repaid in loyalty, harmony, and productivity.

In focusing on removing sociocultural barriers, an organization should take the following actions:

- Develop guidelines for systematically identifying and eliminating sociocultural barriers
- Train managers and supervisors in sociocultural barrier recognition and removal
- Establish a mechanism for open communication and feedback about sociocultural issues
- Develop a reward and recognition system that promotes and is sensitive to healthy sociocultural behaviors and relationships
- Consider "management-by-walking-around" behavior an essential part of management behavior
- Ensure that top-level managers are present at CIP activities, team kick-offs, milestones, and success celebrations
- Recognize that while walking around takes time away from work on the traditional in-box and firefighting issues, it is equally important, has economic value, and will ultimately reduce the need to spend time on the in box.

Removing Roadblocks and Bottlenecks

Roadblocks are impediments to progress or obstructions that prevent individuals, teams, and organizations from meeting objectives. Roadblocks exist in every organization; some are blatantly obvious while others are deceptive. They are deadly enemies of continuous improvement, and eliminating them requires vigilance and aggressive action. Every manager must be a roadblock remover and

improvement facilitator for his/her people and processes. Every individual should contribute to the roadblock removal process.

A roadblock can be any factor that impedes the optimum performance of an individual, group, or process. Managers must understand that numerous and often very subtle roadblocks exist in every organization. New roadblocks are constantly occurring, and no organization is ever entirely free of them. Identifying and removing them, therefore, must be a continuous management activity. Among the techniques and tools useful for that purpose are process analysis; signal analysis; and open, responsive communication systems.

Roadblocks, as illustrated in Figure 4-36, are most often people-created barriers that hinder the ability of others to take action. Roadblocks are encountered by individuals or teams in the course of exploring or pursuing change. Roadblocks are associated with change as opposed to business as usual because operations consistent with the status quo are almost always already relatively free of roadblocks or work would not get done. Management attention is generally needed to remove roadblocks and to facilitate change.

Bottlenecks, on the other hand, are process limiters. They determine the capacity or capability of a system and restrict the rate, volume, or flow of a process. They can never be totally eliminated from any system; they can only be changed from one source to another. Process capacity and capability can be increased through changes that affect the bottlenecks. For example, in the simple five-stage process illustrated in Figure 4-37, Stage 2 has a capacity of processing five units per hour, the lowest capacity among the process stages. Thus, Stage 2 is the bottleneck in the process. The overall process capacity cannot be increased without improving Stage 2 capability. Any effort to improve the capacity of the other stages would be wasted if Stage 2 remains unchanged.

By adding a new and faster Stage 2 capability in parallel with the existing process, as illustrated in Figure 4-38, the total Stage 2 capacity is raised to 15 units per hour. Stage 2 is no longer the bottleneck; that status would now belong to Stage 5, which would have a limiting capacity of 7 units per hour. However, as shown in Figure 4-38, after determining that Stage 5 is limited by the set-up procedure, that procedure can be improved and its capacity increased to 16 units per hour.

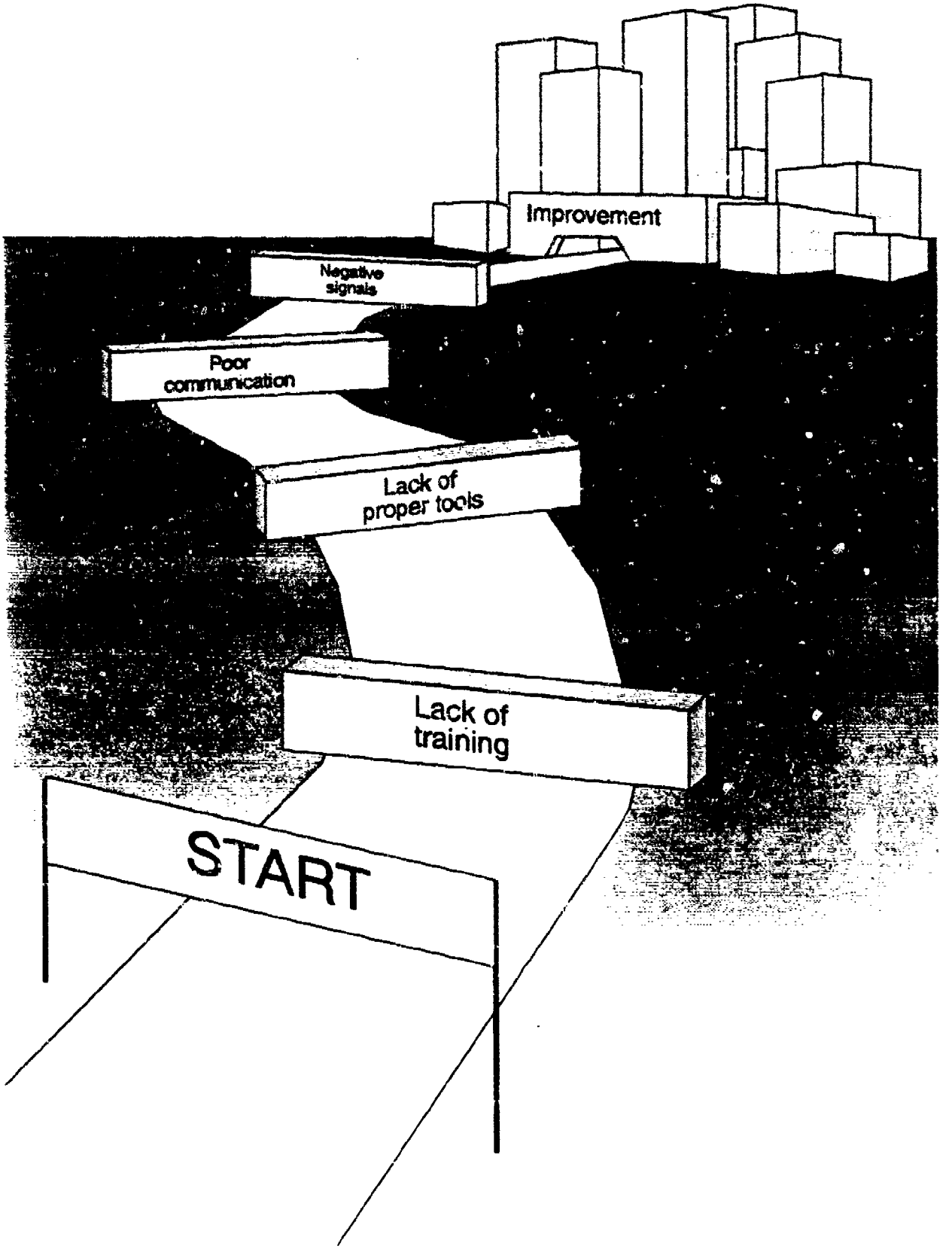


FIG. 4-36. EXAMPLES OF ROADBLOCKS ON THE ROAD TO IMPROVEMENT

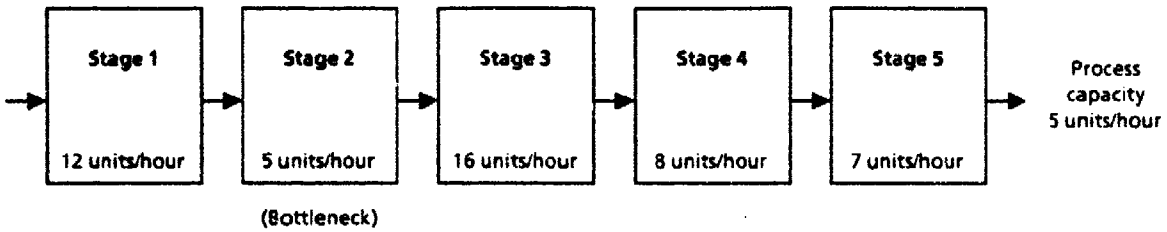


FIG. 4-37. UNBALANCED PROCESS DESIGN (WITH BOTTLENECK AT STAGE 2)

At the point illustrated in Figure 4-38, any further increase in process capability requires work on improving Stage 4. This cycle of identifying and attacking bottlenecks can conceivably continue without end. As each bottleneck is removed, a new one takes its place within some higher overall performance level. After all the remaining stages are successively improved, as shown in Figure 4-39, Stage 2 is again the bottleneck. However, the system now has a total capacity three times greater than before the bottleneck removal and improvement process began.

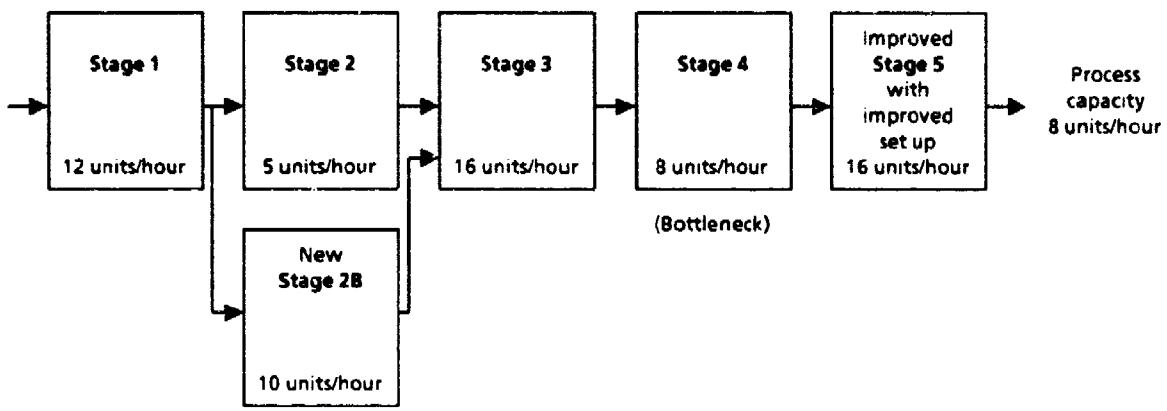


FIG. 4-39. EXAMPLE OF IMPROVED PROCESS DESIGN

This example illustrates that bottlenecks can never be totally eliminated, but only shifted with a net improvement possible with each shift. The key in bottleneck management is first to be certain about the overall process goal, then analyze the process sufficiently to be clear about the current bottleneck, and finally systematically eliminate each bottleneck in turn until the process is improved to a level compatible with the goal.

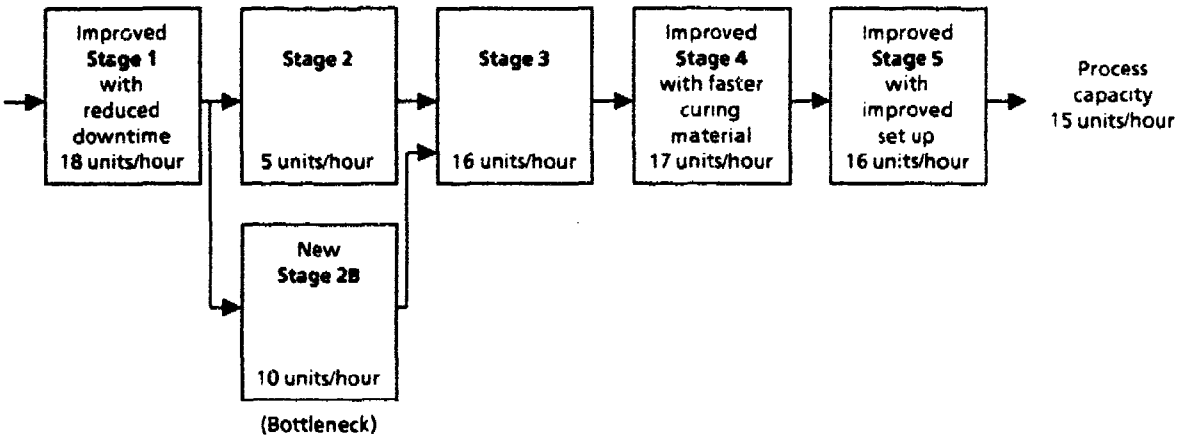


FIG. 4-39. EXAMPLE OF NEARLY BALANCED PROCESS DESIGN

The CIP organization works continuously to identify bottlenecks and to systematically remove them. Bottleneck analysis and process flow analysis are two techniques used to identify and deal with bottlenecks.

To remove roadblocks and bottlenecks, an organization must take the following actions:

- Prepare and disseminate guidelines for systematically identifying and eliminating roadblocks and bottlenecks
- Provide training for managers and supervisors in roadblock and bottleneck recognition and removal
- Establish a mechanism for open communication and feedback about roadblocks and bottleneck issues
- Develop a reward and recognition system that promotes roadblock and bottleneck removal
- Consider roadblock and bottleneck removal behavior an essential part of good management behavior.

SUPPORT OF CONSERVATION OF HUMAN CAPITAL

People are an organization's most important asset. They are its repository of knowledge and its source of ideas for improvement. Conserving this valuable asset requires enlightened and consistent leadership and a stimulating, secure, and

supportive environment in which teamwork, creativity, and pride of workmanship can thrive.

We are moving deeper into an Information Age where ever-increasing quantities of information will be exchanged across great distances in ever-shrinking spans of time. Advanced flexible technologies will permit fast and efficient response to global marketplace changes. Developments anywhere in the world will have direct and immediate impact even on local business decisions. The Information Age will also require organizations to have better human capabilities such as faster and better decision making and more skilled and competent labor forces. Human knowledge, still accumulated slowly by individuals through study and experience, will continue to be necessary to mediate the application of information and technology.

The Information Age will be less forgiving of poor decisions. Organizations caught short of skilled labor may not have time to acquire or develop needed skills and knowledge. Conserving human capital will be essential because finding and retaining individuals with the particular skills and knowledge required for the organization to function successfully in this environment may become more difficult. Nurturing, developing, stimulating, and employing the intellectual capacity of every individual employee will be a key to survival and success in the Information Age.

Conserving human resources will require deliberate effort by top management, internal environmental change, and changes in how most organizations approach hiring and training. Conservation will require a working environment in which each individual is encouraged to think about ways to better accomplish work. It will require management to stimulate, recognize, and reward the intellectual potential and contributions of all its people. It will require that employees be treated as whole persons with opportunities to express their ideas and to influence their work environment. In difficult times management will need to exhaust every available avenue for cost cutting or realignment before resorting to traumatic work force reductions.

The organization that seeks to conserve human capital will invest in knowledge and provide retraining when old skills become obsolete. It will move people into alternative productive employment when their current positions are no

longer needed. With labor, it will jointly seek creative solutions to pressing business problems. In lieu of personnel reductions, it will employ solutions such as job sharing or across-the-board temporary wage reductions that include management. It will expect the best from its people and give them its best in return.

In addition to investing in knowledge and developing a stable, flexible work force, the improving organization will seek to build a happy and satisfied work force through rewarding and recognizing desirable behavior, celebrating successes, and sharing the gains of improvement with the work force.

Rewarding and Recognizing

Reward and recognition are positive means of reinforcing the desired individual and group behavior. They are linked to people's sense of self-worth. Everyone wants, needs, and strives for signs of recognition in their personal and professional lives. Research in human behavior has clearly shown recognition as something people value highly.

A good reward and recognition system will improve morale, reinforce desirable behavior patterns, reward superior performance, stimulate additional improvement effort, inspire creativity, and reflect managements awareness and involvement. It will make optimum use of communication media to obtain maximum exposure and benefit from the reward and recognition process. It will be a flexible system to encourage management creativity in providing recognition, and it will provide for variety and an element of surprise in the rewards and recognition given.

Organizations often use negative reinforcement or punishment to discourage mistakes, defects, or undesirable behavior. Those negative approaches are frequently ineffective because the punished individuals often have little control over the source of problems, which more often than not reside with the management system. While negative reinforcement may still have a limited place for dealing with extreme situations in the improving organization, it will do more harm than good unless employed with great care. It must only be applied with absolute certainty that the punished individual is fully responsible and in control of the undesirable behavior.

Top management is responsible for creating a reward and recognition system that modifies undesirable behaviors and reinforces desirable ones. The Executive

Steering Committee (ESC) should review and oversee the organization's reward and recognition plans. It is far more important to make participating in CIP an enjoyable and intrinsically rewarding experience than it is to make it a lucrative experience. Most organizations concentrate on nonmonetary means to generate and sustain the CIP momentum. A monetary motivator, while occasionally appropriate, should be employed carefully, selectively, and sparingly. Experience has demonstrated that money as a motivator for CIP behavior often has counterproductive side effects: fair distribution is difficult, competitive behavior is supported rather than team behavior, teams are encouraged to play number games in the measurement process, and teams are disappointed when they do not receive the reward.

In recognizing individuals, management must seek ways to prevent problems from occurring as well ways to solve problems or achieve improvement breakthroughs. Broad use of a deserved pat on the back, a sincere thank you, a public acknowledgment at a meeting or in the organization's newspaper, a cake, or a party are generally more effective at motivating overall improvement than occasional bonus checks to selected individuals or outstanding contributors. Most people have little expectation of becoming an outstanding contributor.

The CIP organization provides appropriate and certain reward and recognition to reinforce desired behavior. Management understands the truth in the adage, "That which is rewarded gets done." The rewards and recognition are largely nonmonetary and employed liberally and often. Small but frequent rewards are preferred over those that are large but infrequent and uncertain.

Management spends considerable effort to carefully design and assure the proper employment of the reward and recognition system. The types of behavior and the events to be recognized are defined and documented. A wide diversity of reward and recognition mechanisms is sought and employed. The technique of signal analysis is used to identify and remove negative signals and counterproductive behavior from the system.

In rewarding and recognizing its people, an organization should take the following actions:

- Establish clear guidelines on desired behavior and its reinforcement through reward and recognition

- Train managers in creative employment of the reward and recognition system
- Cite managers for their behavior in appropriately rewarding and recognizing their people
- Employ frequent and flexible nonmonetary rewards for a broad array of desirable behavior
- Develop a reward and recognition plan that is understood by all levels in the organization
- Use negative means such as punishment only in extreme circumstances and only with certain knowledge of their appropriate application
- Make optimum use of communication media to obtain broad awareness of reward and recognition actions
- Ensure that top management is actively engaged and clearly visible to the work force in the reward and recognition process.

Celebrating

Celebration is the observance of a special occasion with festivities or other deviation from the everyday routine. The continuously improving organization celebrates often. Celebration creates a sense of family and builds enjoyment into the improvement process. It is an essential part of the reward and recognition process. The vitality of the practice of celebration is truly a barometer of the vitality of the CIP culture.

Continuous improvement can and should be enjoyable and rewarding. Top management is responsible for creating a working environment that puts joy in improvement. Celebrating success through many and diverse mechanisms is part of that environment. CIP organizations routinely celebrate success. "Are we having fun yet?" becomes a theme question for managers to gauge whether the character of the improvement process is sufficiently positive.

The best organizations mark all important CIP milestones with celebration. As new process-improvement teams are launched, they celebrate; when team anniversaries are marked, they celebrate; and when improvement goals are met, they celebrate. The forms of celebration include everything from pats on the back; announcements; hero photo boards; awards; and parties to free meals, formal dances, annual picnics, and family vacations.

Celebration brings people together and with all its many possible forms is a versatile and successful motivational tool. It is important for managers to celebrate with their people. Top managers especially should be present on very special occasions, providing reward and recognition to appropriately link the festive event to the cause for celebration. At one South Texas company, a senior manager celebrates birthdays by hand-delivering a birthday card with a personal note of appreciation explicitly citing specific examples of the individual's contributions over the year. This form of celebration is extended to every person in the organization at the individual's own work station. While this may seem an extravagant waste of valuable management time, the company has exceptionally high morale, loyalty, and productivity in part due to its propensity to celebrate.

Celebration and recognition are inextricably linked. Celebration and recognition of the individual or group generates winning spirit and builds bonds of belonging. One Central Florida company, for example, celebrates the completion of each improvement team's PDCA cycle with a ceremony led by a top manager who adds a milestone marker to a prominently displayed team improvement plaque. Other forms of celebration include family picnics, dances, luncheons, dinners, and trips. The form of celebration matters less than the fact of celebration.

Celebration and recognition go together and may be considered different forms of the same concept. They can help make difficult jobs bearable and let employees know that management appreciates effort and contribution. Celebration and recognition should immediately follow the accomplishment being celebrated. Management should make the event a personal experience for the recipients as well as a personal expression of appreciation from the managers. It should let the employee know that management is aware of the individual or team presence and is interested in what is being accomplished.

In celebrating the success of its people, an organization should take the following actions:

- Establish clear guidelines about celebration and ensure that management training addresses the issue of celebrating success
- Make celebration a frequent, meaningful, and personal ritual for individuals, teams, and families

- Ensure that top management participates routinely and actively in the celebration process
- Employ nonmonetary means to celebrate success in preference to motivating with money
- Include customers and suppliers in an appropriate way in a celebration
- Link celebration in a timely way to the specific events or behavior being celebrated
- Make celebration a diverse and varied expression of appreciation that recognizes small accomplishments as well as large ones.

Gain Sharing

Gain sharing is a mechanism by which an organization shares the benefits of improvement, including profits, with its employees. Approaches to gain sharing range from suggestion awards paid directly to individuals to employee stock ownership plans to profit sharing among all employees where everyone gets an equal percentage of base pay as a bonus. The concept of bonuses is widely employed in Japan and often is a principal source of employee compensation.

When properly structured and managed, a gain-sharing program can be a significant force for getting everyone to pull in the same direction and for linking organizational success with personal success. However, poorly designed and managed gain-sharing programs can be divisive and counterproductive. Great care must be given to devising a gain-sharing plan and formula that is appropriate for the organization and valid for both the short term and the long term.

Among the popular formula-based gain-sharing plans in use in the United States are the Scanlon Plan, the Rucker Plan, and the Improshare Plan. The Scanlon Plan was developed in the mid-1930s as a financial reward scheme linked directly to productivity improvement. The Rucker Plan, developed in the late-1940s, uses a formula based on a ratio of value added to payroll cost. The Improshare Plan, which also uses a formula to compute profit-sharing, was developed in the mid-1970s as a simpler scheme for computing productivity improvement. While the Scanlon and Rucker Plans require that substantial cost data be collected to compute productivity changes, the Improshare Plan is based on direct and indirect labor hours instead of cost.

Improvement gain-sharing approaches may also be structured on productivity improvements measured at the process level and distributed to either the process-improvement teams or pooled and shared organization-wide. Such improvements as measured savings from reduced scrap, rework, or processing time can be included in the productivity-improvement computations.

Team and individual bonus systems may also be employed as gain-sharing mechanisms. Such systems could include predetermined bonuses for achieving specific improvement objectives. The objectives may be negotiated or may represent a stretch goal from historical performance levels. Each gain-sharing system comes with its inherent risks. If employees become dependent on the gain-sharing income and the opportunities for productivity gains decline, morale may suffer. If the gain-sharing formula is largely influenced by factors beyond employee control, the system may become a source of frustration rather than motivation. If the gain-sharing system provides rewards that are largely automatic and require little employee thought or effort, the program will not be a significant motivator of change. If employees generate improvement ideas but find that management discounts their value or ignores them, the system may sow the seeds of discontent.

Top management must carefully consider and design its gain-sharing plan to assure that it has the desired impact. Simple plans are often easier to understand and manage, more flexible, and more successful than complex ones. Involving the employees in the discussions and decisions about gain sharing, while having its risks, may prove a wise approach. Many good ideas are to be found in the employee knowledge pool and the final product may be more fair and acceptable because of shared ownership of the plan.

To share gains with its people, an organization should take the following actions:

- Develop a clear policy about gain sharing and provide management guidelines for its fair administration
- Provide management and employee training in the gain-sharing process
- Have a plan that ensures equal opportunity for all employees to benefit from the gain-sharing process
- Ensure that the gain-sharing formula is based on factors that are largely under the control of the employees

- Make certain that the gain-sharing plan is suitable for the long-term goals of the company and not designed merely for the immediate situation
- Ensure that managers facilitate employee participation and access to gain sharing and become partners in the process rather than adversaries.

SUPPORT OF TOTAL INVOLVEMENT

Total involvement of people is key to successful CIP. Participation, involvement, and empowerment begin at the top and flow down into the organization. Total participation requires management to enable every individual to get involved and assume responsibility for seeking continuous improvement at both personal and team levels. It is stimulated by supervisors who become actively involved in the education and training of their people. Managers and supervisors demonstrate their commitment by practicing the fundamentals of continuous improvement before expecting the employees to practice them. Active participation and personal demonstration of improvement-oriented behavior is the essence of individual CIP responsibility. That individual responsibility for quality and improvement cannot be delegated; it is part of every individual's job and cannot be transferred.

Empowerment requires management to give people greater authority to make decisions and to initiate improvement actions within their areas of responsibility and expertise. Empowerment is a source of pride and creativity and an engine for improvement action. Participation and empowerment are stimulated, nurtured, and guided by management involvement, teamwork, clear objectives, and vigorous open communication. Management gives respect and authority commensurate with responsibility and participation and in return expects employees to exercise self-direction and self-discipline. Improvement ideas flow from the minds and job actions of empowered individuals.

Teamwork, structure, and discipline play an important role in sustaining involvement and empowerment. Structure is provided, in part, through the integrated network of process-improvement teams. Discipline is provided through the use of specific techniques, tools, and improvement projects. Teams meet regularly to work on process-improvement issues and each team always has a specific improvement project or goal.

Total participation and empowerment depend greatly on management attitude. Managers must accept the decentralization of decision making and be willing to share power and responsibility. They must recognize work accomplishment is a cooperative enterprise and trust employees to do their part without coercion. Training is crucial and managers must recognize and fulfill their role as mentors and teachers. Managers must recognize that everyone has ideas of value and that the synthesis of many ideas often yields the best result. Employees must find managers eager to hear their suggestions, willing to implement the feasible ideas, and able to offer plausible explanations for those not implemented. Top management must find ways to recognize group achievement and resist giving credit or holding responsible individual managers when decisions are group decisions.

Total participation and empowerment extend beyond the confines of the organization. While they begin with top management and flow down through the organization to embrace all employees through training, teamwork, and individual ideas for improvement, they extend beyond to ultimately embrace customers, the union, and suppliers in the improvement process.

Involving Employees

Employee involvement in continuous improvement is ultimately the engagement of the individual in a personal striving for improvement. Real involvement requires total mental participation, while simple involvement may be just a matter of physical presence. Involvement requires personal time and effort beyond the simple requirements of the everyday job and involves thinking and caring about the job, the organization, and about fellow employees. It is ultimately a personal decision that cannot be mandated by the organization but rather must be invited and elicited by a supportive organizational environment.

The issue for the improving organization is how to create an environment that will invite real individual involvement. One basic ingredient of any such environment must be management's respect for individual dignity and identity. Opinions, ideas, and feelings are manifestations of self-image. Managers must be willing and able to listen and to help individuals express opinions, work through feelings, and develop ideas in supportive noncritical ways. Managers must also encourage innovative thinking, trying new approaches, and taking measured risks

without fear of retribution or loss of dignity with failure. Support of self-expression and risk taking is essential in developing employee involvement in improving organizations.

Leadership is another ingredient in the formula for creating an environment for employee involvement. Leadership is demonstrated by a manager's behavior and personal involvement in improvement activities similar to those expected of subordinates. Leadership is manifest in hearing, respecting, and reacting to employees' needs. The true leader leads by example and by offering a helping hand. The true leader provides instruction when needed, shows the way, provides the means, clears away the obstacles, and encourages independent initiative while developing team spirit and teamwork.

An early key step toward involvement is individual participation in structured team process-improvement activity. While involvement ultimately flows from a voluntary personal decision, participation or membership in a process-improvement team comes from holding a job that is part of the process to be improved. There is some disagreement about whether team activity should be mandatory or voluntary; total involvement and empowerment implicitly favor mandatory membership in the improvement team associated with individual's natural work group. Active involvement in the team activities, however, is not coerced. Involvement in special and cross-functional improvement teams generally involves issues beyond the boundaries of one's own job or process, entails greater responsibility, and is typically voluntary or ordained by the expertise of the team members.

Total employee involvement in active improvement effort is an ideal that will never be fully realized. Personnel turnover, individual resistance to change, and the normal day-to-day disruption in the organization will tend to limit the level of active involvement at any given moment. However, most organizations can easily achieve 30 percent active participation within 5 years and rates between 80 percent and 95 percent of all employees are entirely feasible in the organization with a mature improvement culture. The top management involvement should be as close to 100 percent as possible. New managers should be educated in the principles and practices of continuous improvement upon arrival and should be integrated into the management improvement team immediately.

Individual and group involvement in continuous improvement activity must be vigorously encouraged and carefully nourished to sustain momentum. Each effort will occasionally require a jump-start from top management to prevent the day-to-day demands from overwhelming the longer term improvement activity. Once a division, group, or process area has become actively involved in CIP, management must ensure that appropriate mechanisms are in place to sustain its ongoing involvement. Some organizations become entrapped by a different distraction. They become so enamored with starting new improvement efforts that they neglect those areas already under way. Individual involvement and team improvement activity will soon disappear without nurturing and attentive management attention.

To actively involve its employees in continuous improvement activity, an organization must take the following actions:

- Establish clear guidelines on manager and employee involvement in improvement activity
- Provide management training in interpersonal and leadership skills
- Recognize that real involvement in improvement activity is a personal decision, involving some ego risk and that willingness to take such risk is significantly tied to the organizational environment
- Develop an environment in which the individual is respected and managers listen to them and help them grow
- Create an atmosphere in which taking risks is encouraged, failure is acceptable, and innovation is valued
- Build a strong management ethic under which managers set the example and actively lead the improvement effort
- Develop improvement process-sustaining mechanisms to assure that improvement efforts, once started, are not neglected nor allowed to wither
- Make it clear that people are automatically members of process-improvement teams because their jobs are part of the process, but allow active involvement in improvement activity to remain a desirable, encouraged, but personal prerogative.

Generating Ideas – Suggestion Systems

Ideas are the seeds of change. Everyone has ideas, but only when those ideas are reasonable, directed at a problem area, and received in an environment in which

change is an accepted procedure will they be tested and incorporated into a process. The improving organization must deliberately shape its environment to seek the ideas of all its people. Establishing well-managed suggestion systems is part of that deliberate effort, and training, evaluating, and rewarding managers for responsiveness and support of improvement ideas is another.

Continuous improvement depends on the continuous generation of new ideas for improvement. One way that management can stimulate the flow of those new ideas is to create a vigorous system for soliciting, evaluating, and implementing suggestions. Such a system must be positive, responsive, and rewarding. The suggestion system must be a process by which ideas can be easily communicated, fairly evaluated, and rapidly acted upon. It must not be a program in which ideas disappear into a suggestion-box black hole. The regular involvement and stimulation of team activity plays an important role in the generation of individual initiatives.

Employee improvement ideas may range from vague conceptions of improvement opportunities with little specificity regarding solution approaches to clear and well formulated plans of action. Management must be prepared to accept and help develop those ideas, whatever their initial state. Some of the best improvement opportunities may be initially perceived by employees who lack sufficient skills to develop their thoughts into specific plans. The improving organization will establish mechanisms to assist employees in developing their ideas. Such mechanisms might include individual one-on-one coaching, management suggestion review committees, or process-improvement-team discussion and development.

Management actively seeks to stimulate individual and team ideas for improvement. Idea stimulation may take a variety of forms including education, conferring, brainstorming, publication, solicitation, structured analysis, problem solving, monetary reward, and various other forms of recognition. Several attributes stand out as characteristics of the best idea-generating practices. The aim of the system is to help make people improvement conscious and to foment a positive dissatisfaction with the status quo and promote a search for a better way. Teams and individuals are recognized for effort and rewarded for the quantity of useful improvement ideas as well as for their impact. The organization should view any monetary benefit resulting from implementing improvement ideas as a byproduct

rather than the primary purpose of the system. The health of the system is gauged far more by the number and quality of ideas produced than by the net monetary value of those ideas.

People are particularly encouraged to develop ideas for improvement in their own jobs and processes and to take responsibility for implementing those ideas. They should generally be able to test their ideas and implement them with support of the team and management as necessary. The ideas should focus on actions that use existing resources and improve the existing work standard. Supervisors should encourage any idea that makes a job easier, more enjoyable, safer, more productive, faster, less costly, or reduces variation or improves quality. The increment of improvement or economic savings need not be quantified for an idea to be considered appropriate and valuable. Ideas submitted to the suggestion system process should not be required to meet any economic benefit criteria in order to qualify for management attention and action. An important measure of the health of the suggestion process is how many suggestions are generated. A primary purpose of a suggestion system is to stimulate people to think about improvement, and the system should convey the message that every idea, no matter how trivial, is valued.

Many good ideas require only a small investment, can be dealt with immediately, implemented quickly, and recognized appropriately and collectively. While not subjected to economic payback analysis, their value should be readily and logically perceived. They should generally involve actions that the team or individual can implement and should typically be presented to a supervisor orally rather than in writing. Within a week the supervisor should either indicate approval to implement a small idea to test it or should provide an explanation of why it has been rejected. The bias should be toward testing. Successfully tested small ideas should then be appropriately documented and due credit given. The vast majority of ideas are easy to test through a mini-PDCA approach for little or no investment but an economic payback is difficult to quantify. Any idea that has any marginal potential to make a process better, easier, faster, cheaper, or safer should be tested. The argument can be made that if it is quick and easy to do, has no negative effect – even though its only clear positive effect is to make the originator happier about his job – it is worth doing. His next idea may be a real winner.

Large investment or major savings suggestions, typically about 1 percent of the total number of ideas, should be documented first and reviewed at a higher

management level. Fast review and response is still essential. The emphasis is still on an idea that relates to the originator's own process so that the originator is directly involved in its implementation. However, no limitation is placed on the subject matter of ideas since generating a large number of ideas is an objective of the process.

The suggestion system, or idea-generating process, is not an independent program but rather is an integral part of the organization's process-improvement-team structure. The volume and quality of ideas should bring credit to the teams as well as to the individual contributing members. Every suggestion should be recognized and rewarded. Whether the transaction is for pennies or for millions is not as important; as in cash flow, it is the net flow that counts. Since improvement is everyone's responsibility, associating specific monetary compensation with every improvement is contrary to the overriding CIP philosophy and is generally counterproductive.

A suggestion database is often useful to support a vigorous idea-generating process. Such a database can help speed the suggestion-screening process, prevent repeated consideration of the same or virtually the same idea, provide a valuable source of success stories, and support economic and technical analysis.

To stimulate the generation of ideas, an organization should take the following actions:

- Develop clear guidelines for establishing and operating an idea-generating process, including a viable suggestion system
- Provide management training in receiving, evaluating, developing, and implementing employee suggestions
- Establish a flexible and appropriate mechanism for recognizing and rewarding individual and team contributions to the pool of ideas and suggestions
- Develop a mechanism to capture and retain a history of implemented suggestions and use that history to continuously improve the idea-generating process
- Expect and reward management behavior that supports and promotes the generation of new ideas, creativity, and improvement
- Implement small ideas for improvement as readily as large ones

- Promote the generation of a large volume of improvement ideas over large payback ideas
- Encourage individuals and teams to generate ideas that they can implement to improve their own jobs and processes.

Involving Customers

Customers are the lifeblood of every organization; understanding their needs and expectations is a precursor to their satisfaction. Involving customers directly or indirectly in the activities and decisions of the organizations is an excellent but underused vehicle for maintaining awareness of changing customer requirements. Customer involvement can be generated in a variety of ways including surveys, facility tours, training, joint problem solving, improvement team participation, customized product design effort, suggestion programs, shared service support activity, on-site customer representation, and customer recognition programs.

Surveys and market research are among the most common forms of customer involvement. These methods are generally indirect, and customers usually are not aware of the specific initiating organization. Some form of surveying customers and conducting market research is appropriate for most organizations.

Facility tours are another method of involving customers. Tours can be particularly useful if the organization permits the customers to meet with and talk directly to the product designers, assembly line workers, or other employees involved in the production and delivery of the product or service. The organization should have a structured means of capturing the ideas and concerns expressed by the customers during the tour. Follow-up question-and-answer sessions at the end of facility tours may provide a useful forum for collecting customer information.

Customer training offers another excellent opportunity for involving customers and gathering customer information. Such training may be specifically product-oriented, or may be related to general topics of mutual interest to the organization and its customers. Whether the training is conducted at the customer premises, at an organizational facility, or a third-party location, a specific mechanism should be available for collecting customer comments, ideas, and information. That mechanism might be to involve the instructors in data collection or to employ posttraining questionnaires or follow-up surveys.

Customer problems with products or services offers an especially important source of customer information and is an important reason for developing positive opportunities for customer involvement. Among the rich sources of customer information are warranty actions, written or oral complaints, and customer-service hotlines. Each of those mechanisms should have a tie-in to the market evaluation and top management decision-making processes. In particular, those mechanisms lend themselves to statistical analysis of customer problem data as input to improvement analysis activity.

Mutual problem-solving activity is an important method of customer involvement. It is particularly useful when a limited number of customers represents a major share of the market for the product or service. Mutual problem solving may be as simple as informal consultation or assistance or may be as involved as joint design engineering teams. It requires astute management, teamwork, and cooperation since compromise may become necessary. Such activity should be based on a well-defined problem-solving process, focus on resolving specific issues of concern to the customers, and have mutually agreed problem identification, objectives, and problem-solving strategies defined early in the process.

Mutual problem solving is particularly important when dealing with and involving internal customers. Relationships with internal customers are generally not encumbered by as many sensitive or proprietary issues as is dealing with external customers. Internal customers' processes are frequently closely tied to the producers' processes. Overall process improvement demands communication, teamwork, and mutual problem solving. One approach to this issue is through participation in joint process-improvement-team activity.

Involving customers in process-improvement-team activity may extend to external as well as internal customers. Customers generally participate by specific invitation rather than by permanent inclusion. A particular customer is included in team activity during those periods when changes are being discussed or actions being planned and implemented that relate directly to matters of that customer's interest. Different customers may be involved at different periods of process-improvement-team activity depending on the goals or projects being pursued.

A customer may be involved in design processes and product configuration decisions particularly when that customer is the sole or primary one or when the

design is for a customized product. Such involvement is commonplace when the Government is the customer, at least with regard to specifications, design review, and approval of design changes. The continuously improving organization seeks ways to make such customer involvement a positive win-win teamwork effort rather than a confrontation.

Suggestion programs may be extended to include customers. Customers can be as rich a source of ideas as employees. Mechanisms to ensure rapid and certain response to customer suggestions are essential. Care must be taken to provide sound rationale for suggestions that are not adopted. Monetary reward for customer suggestions is inappropriate; implemented suggestions usually work to the benefit of the customer in any event. However, some form of recognition such as a letter of appreciation or a visit from a top-level manager should be routine.

Exchange programs are another form of customer involvement. Such programs may involve employees spending time working within the customer's activity or customer representatives assigned temporarily to activities within the organization. Such exchanges are beneficial for both parties and could involve either internal or external customers.

Customer service and support activity is another arena for potential customer involvement. Many organizations look to their customers to perform some degree of preventive maintenance or minor repair. This form of involvement can be a rich source of information for the organization. If well managed, it can help create a positive relationship for both parties. Care must be taken to assure that customer training and service literature are of the highest quality, and that customer tasks are simple, clean, and safe.

Customer reward and recognition may be appropriate in some circumstances. Certainly customers may be invited to organizational festivities and celebrations. Recognition such as "Customer of the Year" or a "Teamwork Award" might be considered. Such awards are particularly appropriate for internal customers since recognition of internal customers may present fewer difficulties than that of external customers.

Measurement is yet another area of customer involvement, particularly with respect to customer satisfaction. The organization should have a means to measure its performance in meeting customer needs and expectations. Such a system may

involve the customer directly or indirectly. The measurement methodology should be well defined and reasonably consistent over time to permit tracking of performance or customer changes and trends. Performance measurement involving internal customers should generally be fairly direct and should include a feedback loop that will allow the customer to validate or fine-tune the results of the measurement process.

To involve its customers in its improvement process, an organization should take the following actions:

- Develop clear guidelines on customer awareness and involving customers in the improvement process
- Provide training in customer relations to help employees recognize, communicate, and develop positive relationships with their customers
- Establish mechanisms to solicit customer ideas, suggestions, and concerns and employ that information in improvement decision making
- Provide customer training that is useful, clear, and simple and that meets customer needs, as appropriate
- Involve customers in problem-solving activity, particularly when the problems under consideration directly relate to customer satisfaction
- Include customers, particularly internal customers directly affected, in process-improvement-team activity
- Involve customers in equipment service activity, as appropriate, but ensure that customer tasks are simple, clean, and safe
- Provide customer recognition especially in appreciation of customer contributions to the improvement process
- Establish mechanisms to involve customers in performance measurement and tie system performance to customer satisfaction.

Involving the Union

Union participation in improvement activity is crucial to organizations that have a unionized portion of their labor force. Unions have a history of opposition to major changes in the status quo and in particular to "productivity programs." Companies that have attempted to implement CIP concepts without first involving

union leadership in the earliest stages of the planning process have generally encountered significant opposition.

Union leadership does not wish to abrogate its responsibility for maintaining power, control, and influence over the decisions that affect union membership. Historically, union power and influence has flowed from its confrontational relationship with management. Many basic labor benefits have been gained through hard-fought battles of the union against strong management opposition. Involving the union will generally require a careful reshaping of labor-management relationships, greater management willingness to share decision making, and clear demonstration that labor and management share common objectives.

Union leaders representing members in the organization should be invited to participate in management teams, in the CIP education process, and in top-level process-improvement planning from the outset. The union leadership should represented at the highest levels of improvement goal setting and be included in CIP decision processes and communications. Experience has shown that union leadership understands and supports CIP where they have been involved early and have had a role in shaping the deployment process with respect to their membership.

Continuous Improvement Process principles, when fully understood and practiced, are compatible with the needs and expectations of both management and labor. Higher productivity should not equate to fewer jobs. Higher quality and lower costs should produce more job security and better compensation through higher customer satisfaction and increased sales.

Union leadership involvement should extend to idea-generating schemes and suggestion systems. Organized labor has proven to be a rich source of improvement ideas and problem solutions when given the opportunity and when the change process is beneficial to both management and labor. Responsiveness and recognition regarding union suggestions should satisfy the same criteria applied to employee or customer suggestions.

Including organized labor in the improvement process may require the disclosure of internal information not traditionally shared. Internal management problems are often considered "dirty linen" to be kept hidden. The development of trust is the key to open communication. Most organizations will explore improvement opportunities in low sensitivity areas first and concentrate on

fostering trust-building experiences. Initial successful efforts serve to build team spirit and open doors for greater engagement.

To involve the union in its CIP, an organization should take the following actions:

- Establish clear guidelines regarding union involvement and encourage union-management cooperation in creating a culture for improvement
- Promote direct participation by union leadership in improvement process activities from the earliest possible moment
- Provide a means by which the unions can submit ideas and suggestions to the improvement process
- Ensure that union contributions to continuous improvement are appropriately recognized
- Involve union leadership in CIP management training
- Include union leadership in problem-solving activity and on top-level process-improvement teams
- Recognize that the union is in fact a customer for some of the organization's processes
- Ensure that union involvement extends to performance measurement activity, particularly where the union meets the criteria of the customer.

Involving Suppliers

Supplier involvement is an essential ingredient in any complete improvement process. Suppliers play a major role in defining the cost and quality of the end products and services. Products and services cannot be substantially and continuously improved without suppliers participation.

A successful improvement strategy must include a means for continuously improving the goods and services that are purchased by the organization. That improvement can only be realized if the supplier base is actually engaged in the improvement process. For the improving organization, suppliers become an integral part of the day-to-day operations. That closer relationship requires new understandings and new supplier management methods.

The new relationships with suppliers that continuously improving organizations develop represents one of the most controversial aspects of the CIP

approach to management. Continuous improvement forces management to challenge traditional thinking about competition and its effect on purchase price. It brings into question laws and regulations affecting purchasing by the Government sector and, in particular, that legislation which is designed to discourage close relationships between buyer and supplier. Such laws and regulations are intended to prevent corruption, promote fairness, create opportunity for new enterprise, and ensure that the Government pays the lowest price. However, past performance indicates that such objectives are not always attained, and better ways may be available.

Private-sector companies that have developed very close relationships with fewer suppliers have found that equally important advantages can be achieved without necessarily sacrificing the broader objectives sought by the Government. Such closer relationships between buyer and supplier have permitted continuous cost reduction through cooperative continuous improvement activity, reductions in variability in purchased materials through better process control and fewer processes, and better investment decision making as a result of longer term planning. Additional benefits include better production continuity, greater flexibility, shorter leadtimes, and JIT inventory management resulting from coordinated production planning and improvement. Improved designs from better design collaboration and lower overhead because of reductions in requirements for inspection, inventory, administrative services, and defect correction are also claimed as byproducts of more cooperative relationships between buyer and supplier.

Improving organizations involve their suppliers in CIP training by educating supplier management teams about improvement processes. They may share their training materials with their suppliers, invite supplier personnel to attend in-house training courses, or even conduct training courses in the supplier's facility. They help to facilitate improvement process implementation at supplier activities including training supplier facilitators or providing facilitation services.

Improving organizations provide meaningful feedback to suppliers on the quality of incoming material as determined by an audit, and they provide that information in sufficient detail and in sufficient time to prevent degradation of incoming quality. When a supplier lacks specific analytical capabilities, the CIP

organization may perform technical analysis and assist the supplier in correcting process problems.

Improving organizations seek to establish joint improvement team activities with suppliers. The organization may include supplier representatives on its process-improvement teams and may also supply its own representatives to participate on supplier improvement teams. They engage in joint problem-solving activity and, where appropriate, joint planning and goal setting.

The improving organization develops mechanisms for evaluating and rating supplier management capability and performance using CIP criteria. It provides feedback to the suppliers on the results of performance evaluations. Suppliers are advised that continuous improvement is essential and that ultimately, business will be conducted only with companies that are willing and capable of continuous improvement.

The CIP organization involves the supplier organizations in its idea-generating and suggestion systems and establishes appropriate reward and recognition mechanisms for suppliers to acknowledge their contributions to continuous improvement.

To involve its suppliers in its continuous improvement effort, an organization should take the following actions:

- Establish a goal of ultimately buying only from suppliers that are committed to continuous improvement and quality
- Develop a plan for actively engaging the supplier base in CIP, including planning, training, problem-solving, and information exchange
- Design a method for rating and tracking supplier performance against CIP criteria
- Publish clear guidelines about involving suppliers in the improvement process
- Provide training in supplier relations to help employees recognize, communicate, and develop positive relationships with their vendors
- Establish mechanisms to solicit supplier ideas, suggestions, and concerns and employ that information in improvement decision making

- Provide suppliers training that is useful, clear, and simple and that meets their needs
- Involve suppliers in problem-solving activity, particularly when the problems under consideration directly relate to customer satisfaction
- Include suppliers as appropriate in process-improvement-team activity
- Provide supplier recognition, especially in appreciation of their contributions to the improvement process
- Establish mechanisms to involve vendors in performance measurement and tie their performance to ultimate customer satisfaction.

CHAPTER 5

CONTINUOUS IMPROVEMENT PROCESS MODEL

A model is a representation of something existing or planned. It provides a useful example upon which to pattern behavior or activity. The value in a model is in its unique power to communicate the essential aspects of its subject. Since every organization and situation is unique, no single model is appropriate for every effort. Each organization must ultimately craft its own approach to improvement based on its own specific needs and imperatives.

In this chapter, we provide a general model of CIP, a model that provides a logical context for implementing the principles and practices discussed thus far. While each organization must ultimately define its own model, our model offers a starting place. It is divided into three general categories: (1) organizational transformation, (2) process improvement, and (3) individual improvement.

ORGANIZATIONAL TRANSFORMATION

Transformation addresses the process of organizational change. It is concerned with management structures, environmental factors, and a broad array of issues relevant to the overall organization.

The CIP transformation model shown in Figure 5-1 focuses on the organizational and behavioral changes you need to instill and sustain a culture of continuous improvement in your organization. It provides a unified, consistent vision of its goals and objectives and allows you to achieve those goals and objectives by providing the leadership and resources necessary to implement CIP and by eliminating any barriers to its implementation. Broad goals are focused down through all the organization's layers, and improvement practices follow a structured, disciplined methodology. Training and team building have fundamental supporting roles throughout the CIP model because people and groups in the organization must be trained in appropriate subjects at appropriate times and groups must learn to function as teams. The ultimate objective is to establish a perpetual and total

commitment to quality throughout the organization, and to involve everyone. CIP should become the organization's way of life.

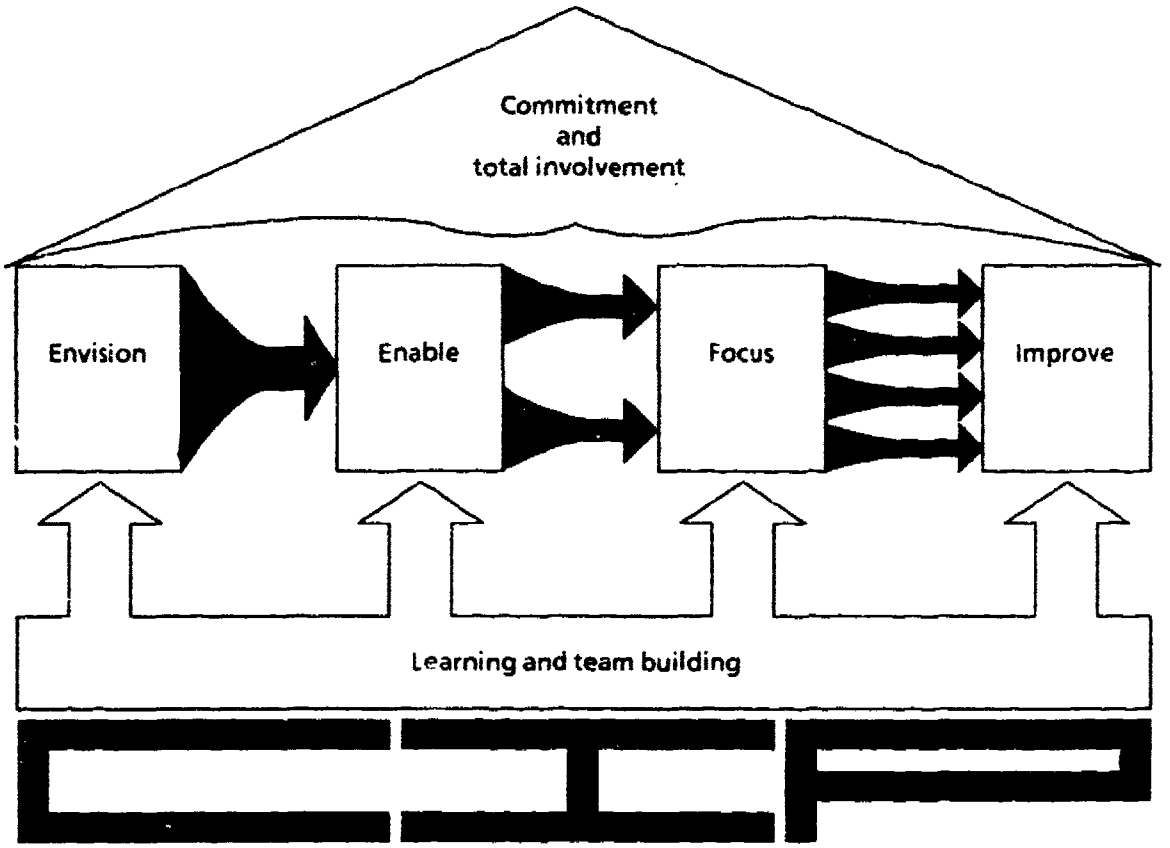


FIG. 5-1. CONTINUOUS IMPROVEMENT PROCESS TRANSFORMATION MODEL

Envisioning

Envisioning (see Figure 5-2) is a process that includes developing the organization's overall mission and goals and building individual and group awareness of CIP objectives, philosophy, principles, and practices within the context of that overall mission. The organization should document its mission and establish the constancy of purpose essential to a successful CIP effort. Creating a customer focus is a key element of improving the organization's effectiveness. Each individual must demonstrate belief in the organization's mission and ownership of its vision. An Executive Steering Committee (ESC) led by the head of the organization guides and leads the overall CIP effort, which becomes integrated into the organization's

way of doing business. The ESC is also instrumental in the achievement of the mission.

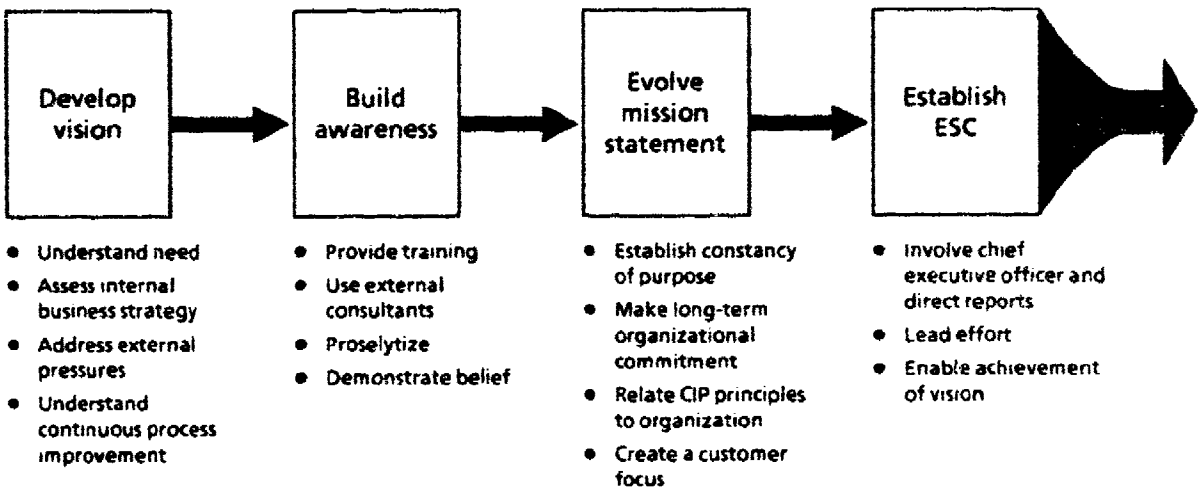


FIG. 5-2. ENVISIONING PROCESS

Enabling

Enabling (see Figure 5-3) is the process by which management makes it possible for the organization to implement CIP principles and practices. It includes individual and organizational efforts to create an environment that will support and nurture the CIP effort. Top management must become committed to the CIP implementation and must demonstrate that commitment; highly visible and vocal champions can help publicize the commitment. Leaders must work to remove barriers to CIP and to establish support, reward, and recognition systems that encourage CIP behavior and drive out the inherent fear of change. Training and time resources are essential. The organization must empower its individuals and groups at all levels by providing them the authority necessary to meet their responsibility for process improvement.

Focusing

Focusing the improvement effort (see Figure 5-4) is a process that turns the philosophy and the broad goals into specific objectives and plans for improvement. Those goals, objectives, and plans are communicated throughout the organization. Efforts to focus CIP implementation must ensure that the organization establishes broad, top-level goals and then aligns all improvement efforts with those goals.

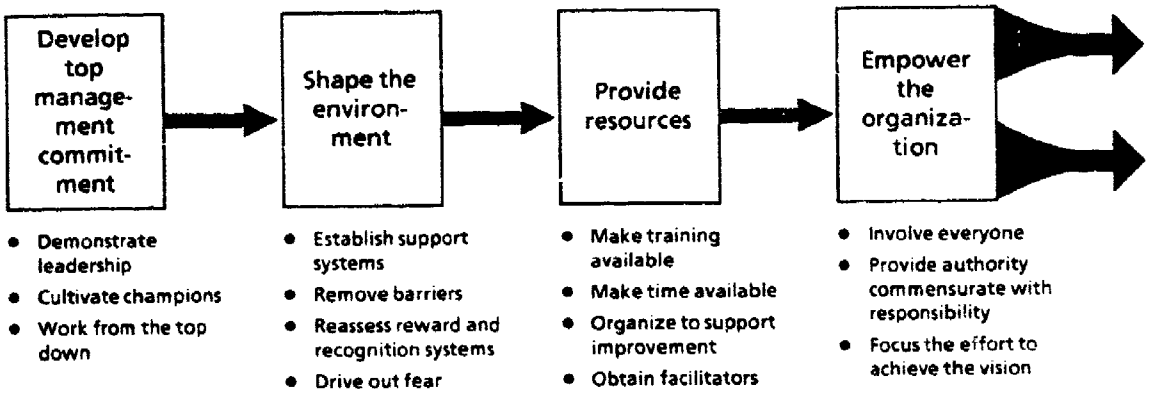


FIG. 5-3. ENABLING PROCESS

Policy deployment translates broad goals into more specific, relevant goals at each organizational level. Goals at all levels must be realistic, achievable, relevant to both the group and the individual, and consistent. Involving customers and suppliers ensures that common concerns are addressed, that customers and suppliers understand each other's needs, and that information is exchanged in a timely and meaningful manner.

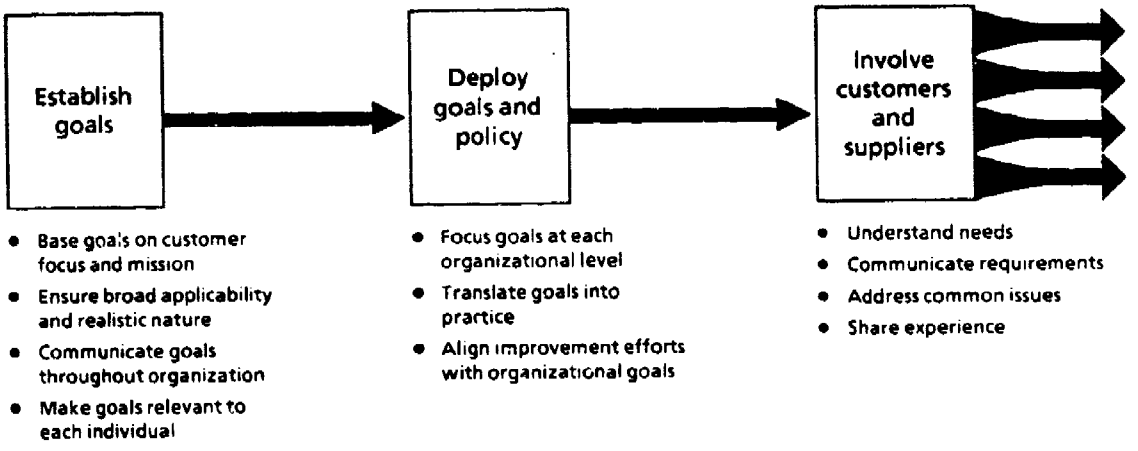


FIG. 5-4. FOCUSING PROCESS

Improving

Improved processes (see Figure 5-5) are the result of envisioning a new way of doing business, enabling that vision, and focusing the effort to achieve specific goals and objectives. The organization's improvement activities include many of the more mechanical definition, standardization, and performance assessment processes. Performance and progress measurement are a critical element throughout CIP. The overriding characteristic of the improvement process is the establishment of, and adherence to, a structured, disciplined process-improvement methodology that allows the organization to take maximum advantage of individual and collective experience and energy and to institutionalize that advantage for the good of the organization.

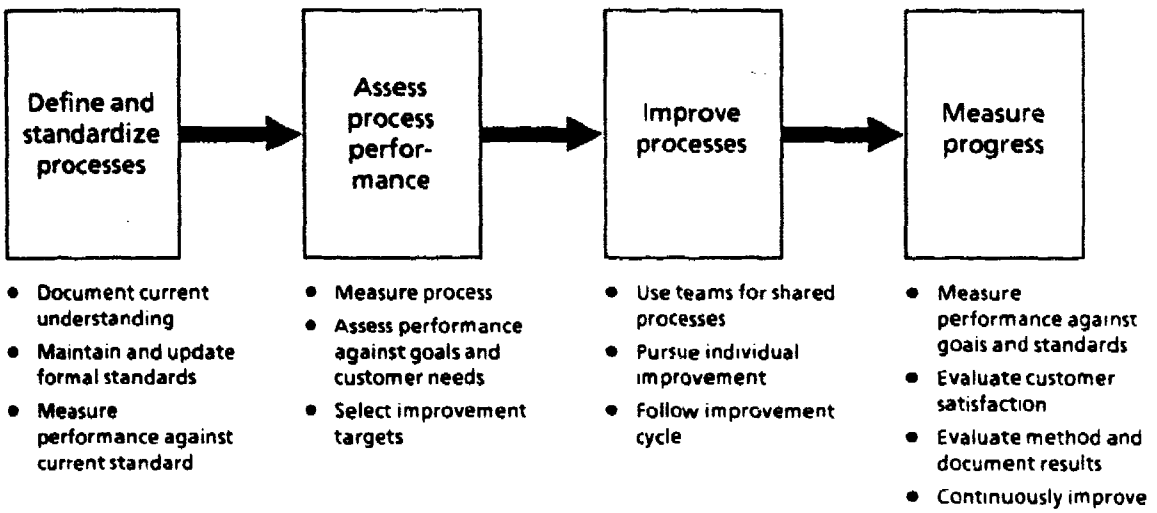


FIG. 5-5. IMPROVING PROCESS

Learning

Learning (see Figure 5-6) is one of the fundamental elements supporting the CIP effort. It comprises training and education. In brief, the objective of the learning process should be to provide each individual and group exactly the right amount of the correct education and training at just the right time. Doing this requires management to identify projected needs from awareness through specific technical skills, to determine how the education and training will be delivered – in a classroom, on the job, or through self-study – and to provide the necessary materials and resources. Management must plan learning so that each person and

group will be able to use that new knowledge almost immediately after it is given. Failure to use the learning at once will result in people forgetting it rather quickly and ultimately in the wasting of this valuable resource. Learning is necessary through each of the four phases of the CIP model, in different amounts of different subjects at different times for different people.

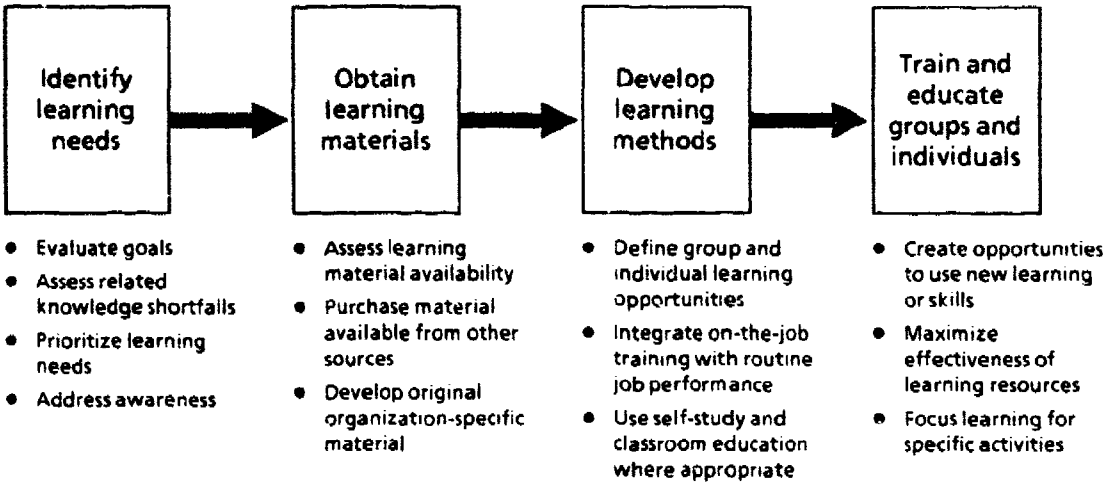


FIG. 5-6. LEARNING PROCESS

Team Building

Team building (see Figure 5-7) is the other fundamental element needed for supporting the CIP effort. CIP will gain much of its power and momentum through the formation and activity of teams at all levels in the organization. Management should form teams according to the overall organizational goals and ensure that the teams have the necessary training resources and time to work effectively. Team building begins with the establishment of the ESC and continues through all levels to the bottom of the organization. In many cases team building simply means training existing work groups to act as teams; in other situations the organization may address common problems and concerns by creating cross-functional teams [sometimes coordinated by Quality Management Boards (QMBs)] that draw participants from all interested areas. All teams should be linked, horizontally and vertically, and should follow the structured process-improvement cycle within the framework of the common organizational goals.

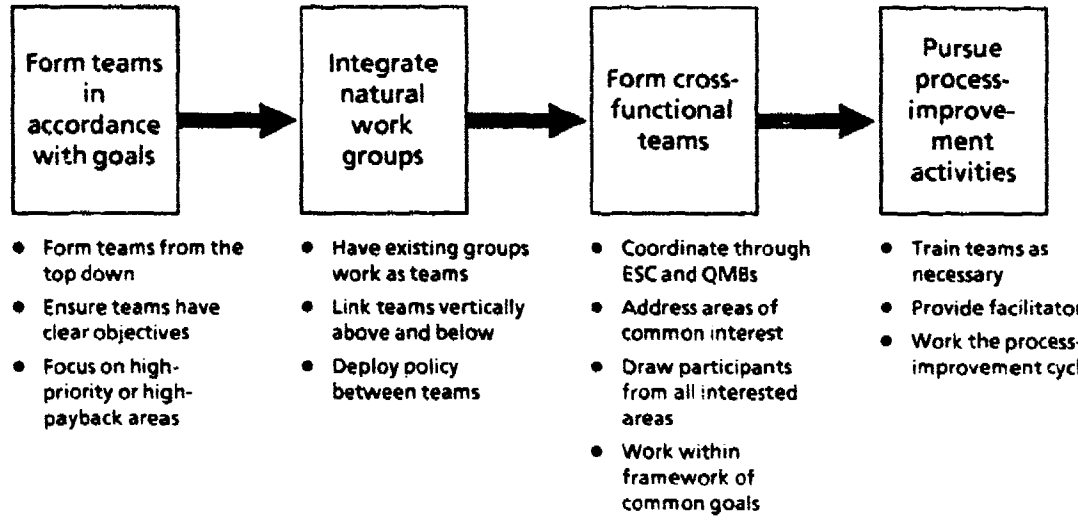


FIG. 5-7. TEAM-BUILDING PROCESS

Transformation Model Summary

The transformation model provides a useful construct for the organizational change process. It provides a specific focus and approach to the task of transformation. The transformation model framework presented in Figure 5-8 and the list of activities shown in Table 5-1 provide a detailed summary of the elements found in the model. The table provides references back to the relevant text in Chapter 3, "Principles" and Chapter 4, "Practices."

Both the individual and the process-improvement methodologies are embedded within the transformation model. They are both key players in the overall organizational transformation and are essential to a successful improvement process.

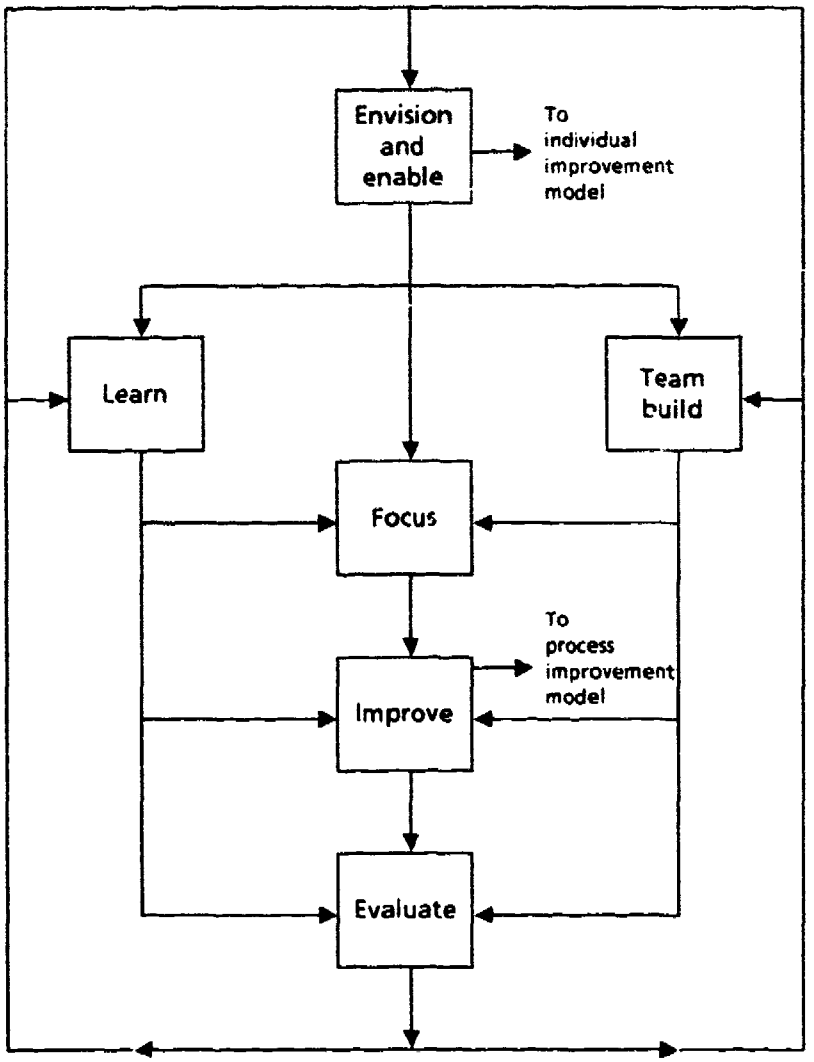


FIG. 5-8. TRANSFORMATION MODEL FRAMEWORK

TABLE 5-1

ORGANIZATIONAL TRANSFORMATION MODEL ELEMENTS

	Reference page
Envision and enable	
Recognize the need to change	Chapter 1
Use outside consultants to start	4-27, 4-31
Develop internal facilitators	4-28
Form a Steering Committee	3-19
Educate members in philosophy	3-17
Establish a vision for organization	2-5
Develop a business strategy	4-2
Prepare mission statement	2-4
Prepare information package	4-28
Make a long-term commitment	3-25
Demonstrate top-management commitment	3-5
Make time for improvement a policy	3-25
Conduct an internal assessment	4-35
Relate principles to organization	3-1
Examine policies and practices	4-5
Examine communications processes	4-28
Open communications channels	4-29
Remove obvious barriers to improvement	4-101 – 4-103
Eliminate systemic sources of fear	4-115
Create a conducive environment	1-8
Examine and improve support systems	4-107
Align reward and recognition	4-108
Conduct an external assessment	4-33
Establish a customer focus	3-7
Understand customer needs and expectations	4-54
Encourage individual effort	4-115
Establish an effective suggestion system	4-117
Stimulate creative thinking	4-118
Empower individuals to make a difference	4-114
Enable individual improvements (see individual model)	4-115

TABLE 5-1

ORGANIZATIONAL TRANSFORMATION MODEL ELEMENTS (Continued)

	Reference page
Focus	
Develop an improvement plan	4-2
Establish goals and objectives	4-3
Develop top-level measurement system	4-64
Inform and involve everyone	4-114
Disseminate information package to everyone	4-28
Discuss CIP throughout organization	2-1
Deploy goals and objectives into organization	4-5
Involve customers and suppliers	4-121, 4-126
Learn	
Define learning needs	4-25
Develop learning systems	4-26
Determine learning methods	4-26
Obtain learning materials	4-26
Teach just in time	3-18
Teach on the job	4-25
Let supervisors teach subordinates	4-25
Provide learning staff support	4-26
Make learning a high priority	4-25
Recognize and reward learning achievement	3-17
Team build	
Cultivate leadership	3-22
Select QMB members	4-15
Establish purpose for QMBs	4-15
Form QMBs	4-15
Create cross-functional teams	4-19
Create special teams	4-16
Train teams	4-25
Designate team leaders	4-15
Remove team obstacles	4-15, 4-18
Form process-improvement teams	4-13
Train improvement teams	4-25
Use improvement projects	4-66

TABLE 5-1

ORGANIZATIONAL TRANSFORMATION MODEL ELEMENTS (Continued)

	Reference page
Team build (continued)	
Integrate natural work-group teams	4-13
Recognize and reward CIP behavior	4-108
Support continuous improvement	4-57
Improve	
Employ a disciplined methodology (see process model)	4-52
Initiate improvement cycle activity	4-52
Develop process/team measurement systems	4-62
Define and standardize processes	4-40
Gain control of processes	4-37
Simplify processes	4-37
Improve processes	4-51
Eliminate non-value-added activity	4-37
Make processes foolproof	4-37
Focus on upstream processes	4-80
Apply simultaneous engineering concepts	4-83
Apply robust design development concepts	4-86
Focus on system inputs	4-76
Apply just-in-time concepts	4-89
Focus on organizational systems	4-98
Apply cellular processing concepts	4-92
Apply leadtime reduction concepts	4-97
Focus on system outputs	4-62
Apply inventory reduction concepts	4-89, 4-90
Focus on downstream processes	4-80
Apply timely feedback concepts	4-62, 4-69
Evaluate	
Measure organizational performance	3-16
Assess and analyze data	4-62
Evaluate improvement results	4-63
Assess progress	4-64
Recycle improvement efforts	4-52

PROCESS IMPROVEMENT

Process improvement addresses the creation of positive change in the way work is done. It includes the definition of work flows, strengthening of supplier-customer relationships, elimination of non-value-added effort, reduction of variation, and control of processes.

The CIP process-improvement model shown in Figure 5-9 is a seven-step process that begins with the activities needed to create an environment conducive to CIP and continues through selecting and improving a process and finally assessing the level of performance improvement, where the model cycles around to focus on another process-improvement effort. This model flows logically from the CIP transformation model.

Step 1: Set the Stage for Process Improvement

At the organizational level, setting the stage for process improvement involves everything the organization does to become aware of the need for improvement and to establish a commitment to continuous improvement. It includes basic education and training, goal setting, barrier reduction, and leadership. Setting the stage means the organization must create an environment in which process-improvement activities are encouraged and nourished. Management must have a clear vision of what it wants to accomplish and where it wants to go, and it must lay in place support systems to help the improvement effort.

At the team and the individual levels, setting the stage involves selecting and educating the team or the individuals and training them in the specific concepts, tools, and techniques they will need for the contemplated improvement effort. The team or individual should determine how to function in the overall organizational environment and should ensure that all individuals involved are determined to accomplish their perceived mission.

Step 2: Select a Process to Improve

A team must identify potential candidates and, in conjunction with organizational and team objectives, select one process on which it will focus its improvement effort on each pass through the cycle. Selecting the improvement target involves identifying all the potential opportunities, setting their priorities, and choosing the process that presents the most serious problem or offers the

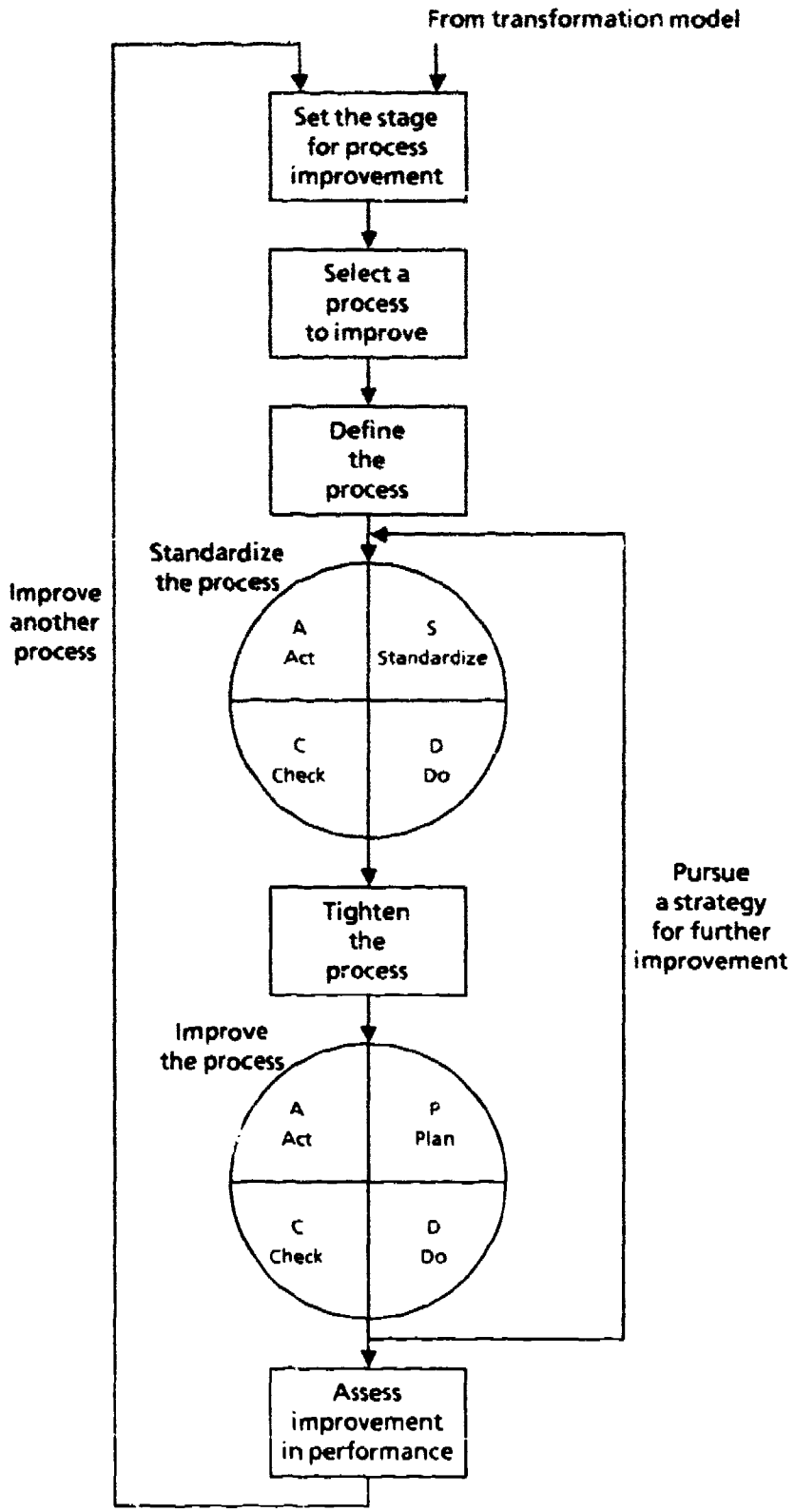


FIG. 5-9. CIP PROCESS-IMPROVEMENT MODEL

greatest opportunity for improvement. Once the process is selected, the team must identify its major problems and isolate their root causes. From this background, the team may create a plan for improvement that builds on the team's objectives. Identifying measurement points is also necessary before beginning the process-improvement effort.

Step 3: Define the Process

Once a process has been targeted for improvement, the team should define that process as clearly and completely as possible. Process definition involves determining the customers (both internal and external) and the suppliers of the process, documenting how the process is currently performed (usually through using a flow chart or diagram), and identifying measures of process performance. Documentation should be formal and consistent among all organizational processes. A firm process definition provides a consistent base from which to begin process improvement; without knowing where you are at a given moment, it is hard to determine how to get to your destination.

Step 4: Standardize the Process

By standardizing a process, the team institutionalizes the current best way to perform that process. It creates a means for instructing people in their jobs within a consistent performance definition, it provides a means for evaluating performance consistently, and it provides a basis for evaluating the success of the improvement efforts. The team accomplishes all this by following the *Standardize-Do-Check-Act* (SDCA) cycle, which initially requires it to bring its measurement system under control, to identify and document the current method of performing the process (which becomes the process standard), and to communicate and promote use of the standard. Management ensures that individuals are trained to the standard, enables its use, and enforces that use. Once the standard is in force, teams measure all process performance against that standard and respond appropriately to deviations from it. Reducing performance variation by assessing the causes of deviation and eliminating them allows the teams to prevent recurrent deviation. The standard should always reflect the best current way of performing the process.

Step 5: Tighten the Process

Once a team has defined a process standard, it should tighten the process before actually attempting to improve it. Tightening is the maintenance work that makes process-improvement efforts as effective as possible. Ensuring that the process meets its stated and perceived requirements; cleaning and straightening the process work areas; eliminating unnecessary equipment; instituting total productive maintenance; and establishing reliable, adequate data-collection systems are essential elements of this effort to tighten the process.

Step 6: Improve the Process

Efforts to improve the process should follow the classic *Plan-Do-Check-Act* (PDCA) cycle in which an improvement plan is available and teams implement solutions, check for improvement, and act to institutionalize the improvements. The team's effort involves developing solutions that address stated requirements and conform to theories on problem causes. Data collection and measurement methodologies must support the envisioned solution. The team must be trained in the techniques necessary to carry out the plan. After it carries out its planned improvement, it should assess the data to determine how well actual performance matches planned improvements. Successful improvements should be institutionalized; less-than-successful efforts require another pass through the improvement cycle.

Step 7: Assess Improvement Performance

After an improvement has been implemented, a team should document the improved performance and the successful improvement effort thoroughly. That documentation allows others to benefit from the lessons the team has learned and brings recognition for the team's efforts. It also provides a road map for replicating successful improvement techniques. Documenting the improved process also requires the team to update its process definition and flow diagrams, and requires that process standards be rewritten to reflect the new standard of performance. Teams should set in place a means of continuously measuring performance level if this system does not already exist. Recommending follow-up actions or subsequent improvement efforts is also appropriate. Finally, celebrate team effort!

Process-Improvement Model Summary

The process-improvement model provides a useful construct for the process-change mechanism. The process-improvement model framework presented in Table 5-2 provides a detailed summary of the elements of the process-improvement model and the Chapter 4 sections, "Support of Process Orientation" and "Support of Continuous Improvement," provide more details about those elements.

TABLE 5-2

PROCESS-IMPROVEMENT MODEL ELEMENTS

- **Set the stage for process improvement**
  - Create the environment
  - Select the improvement team
  - Train the improvement team
  - Educate about improvement tools
  - Discuss mission statement
  - Discuss quality issues
  - Set ground rules and logistics
- **Select a process to improve**
  - Identify opportunities
  - Prioritize and select opportunities
  - Localize the problem
  - Create an improvement plan
  - Establish operational definitions
  - Establish team objectives
  - Identify key measures
- **Define the process**
  - Describe the process or problem
  - Flow chart the process
  - Identify supplier/customer relationship
  - Identify measures of performance
  - Relate measures to customer needs and expectations
  - Assure capable measurement system
- **Standardize the process (SDCA)**
  - Standardize
    - Standardize procedures

TABLE 5-2

PROCESS-IMPROVEMENT MODEL ELEMENTS (Continued)

- **Standardize the process (SDCA) (continued)**
  - Standardize (continued)
    - Assess process stability
    - Reduce variation in measure system
    - Assure controlled measure system
    - Analyze special causes of variation
    - Correct special causes
    - Bring process under control
    - Document the standard
    - Communicate the standard
    - Promote the standard
  - Do
    - Train to the standard
    - Enable the standard
    - Enforce the standard
  - Check
    - Measure results to the standard
    - Respond to deviation from the standard
    - Identify root causes
    - Analyze common causes of variation
  - Act
    - Reduce variation in process
    - Prevent recurrent deviation from standard
    - Document standard improvements
    - Revise the standard
- **Tighten the process**
  - Assess process capability against requirements
  - Streamline the process
  - Error-proof the process
  - Straighten-up the work area
  - Eliminate unnecessary equipment
  - Institute total productive maintenance
  - Document lessons learned
  - Collect and maintain process-performance data

TABLE 5-2

PROCESS-IMPROVEMENT MODEL ELEMENTS (Continued)

- **Improve the process (PDCA)**
  - Plan
    - Develop questions
    - Develop a theory
    - Analyze available process data
    - State a goal
    - Plan a change or test
    - Design system changes
    - Define expected outcomes
    - Identify process measures
    - Plan data collection strategy
    - Establish a test measurement process
    - Test and refine data collection
  - Do
    - Train to the plan
    - Enable the plan
    - Conduct cause-and-effect analyses
    - Carry out the change or test
    - Follow the plan
    - Experiment with process changes
  - Check
    - Observe/collect the data
    - Analyze the data
    - Look for pattern in data
    - Compare data with theory
    - Respond to deviations from plan
    - Identify root causes
    - Determine type of cause
    - Correct special causes immediately
    - Look for alternative solutions
    - Determine impact on outcomes
    - Determine whether objectives are met
    - Determine whether theory needs revision
    - Summarize what was learned

TABLE 5-2

PROCESS-IMPROVEMENT MODEL ELEMENTS (Continued)

Improve the process (PDCA) (continued)
Act
Prevent recurrent deviation
Redesign products or processes
Implement permanent change in the process
Continue to collect and analyze data
Document and standardize the change
Continuously monitor the process
Develop a strategy for further improvement
Repeat SDCA and PDCA cycles
Assess improvement performance
Organize data
Document project results in picture book format
Make final presentations of PDCA story
Evaluate team methods
Evaluate project results
Recommend follow-up activity
Celebrate PDCA cycle completion
Recognize and reward CIP behavior
Select a new process to improve

Team process-improvement activity is a vital part of the organizational transformation process. It focuses collective effort on shared processes and is a crucial element in opening the all important channels of communication. However, the importance of the individual contributions in the improvement process must not be overlooked. Many organizations find that the sum of the improvements generated by individual contributors equals or even outweighs the results of the team efforts.

INDIVIDUAL IMPROVEMENT

Individual self-improvement techniques, both internal and external to formal CIP efforts, provide the means by which any person may apply CIP-style structure and discipline to his/her everyday activities. Individual improvement also addresses

the individual's interaction with superiors and subordinates and with formal organizational systems.

The CIP individual-improvement model, illustrated in Figure 5-10, is an iterative seven-step process that follows the basic guidelines of the transformation model but applies those guidelines to personal individual-improvement efforts. It involves establishing a vision for an individual-improvement effort and enabling that effort, focusing behavior and expectations to achieve continuous improvement in personal performance on the job and in the performance of others, and finally evaluating the efforts to improve.

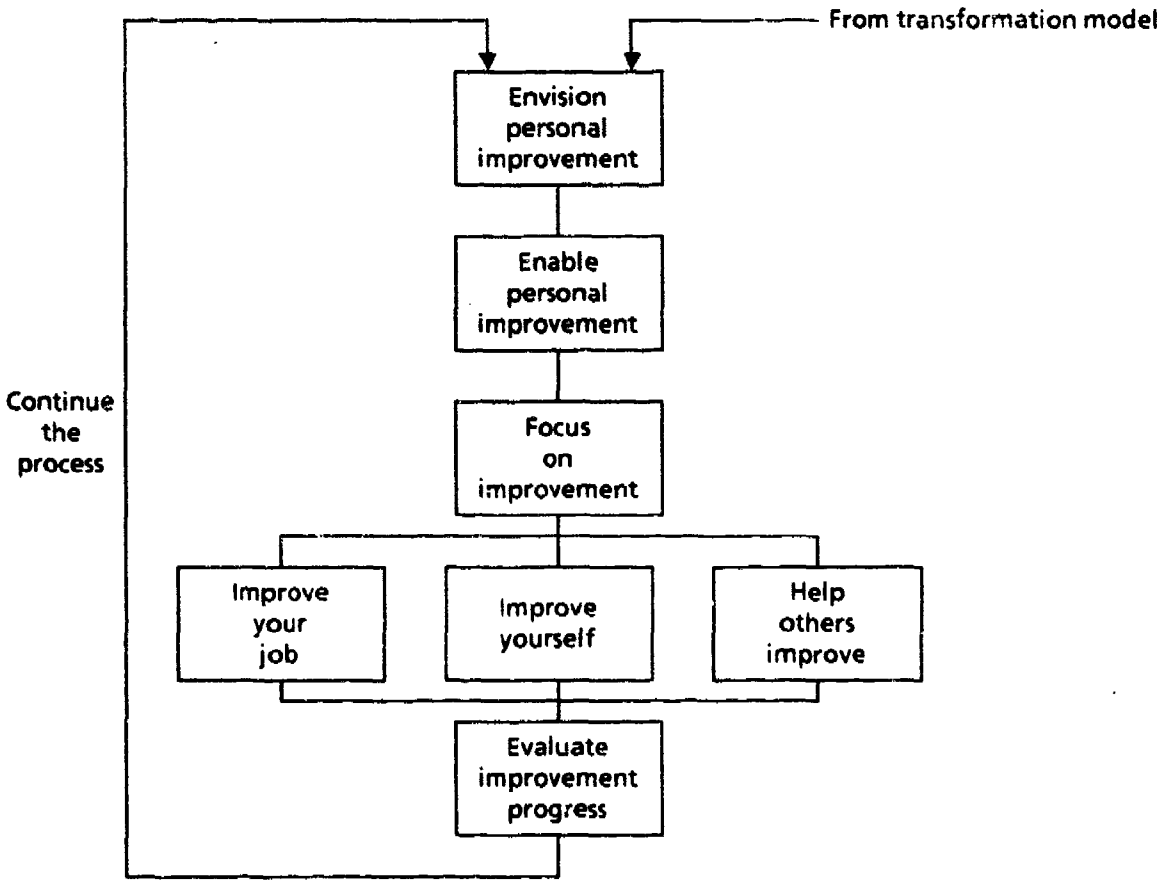


FIG. 5-10. CIP INDIVIDUAL-IMPROVEMENT MODEL

Step 1: Envision Personal Improvement

As the first step in personal improvement, you must decide that improvement is needed and determine where to focus your improvement effort. You should

become aware of both your need to improve and your ability to improve. By assessing your relationships within the organization and with your customers and suppliers, you can develop a fundamental understanding of where you stand at a given moment. From that assessment you should develop your expectations for your own behavior and begin creating your personal vision for your improvement.

Step 2: Enable Personal Improvement

To make your vision for personal improvement a reality, you must begin by smoothing the road along which you will travel. That effort starts with educating yourself about your improvement goals and about CIP concepts, principles, and practices. Seek training for yourself in the skills and principles you see as essential to your effort. Enabling is a process of learning – learning about using CIP tools, about your processes, about the collection and use of data, and about the process of learning itself. In that process, you should seek the support of others, not to gain their approval but rather to enlist their help in removing barriers to your effort.

Step 3: Focus on Improvement

You focus your improvement effort by establishing goals for that effort and ensuring that your improvement activities are aligned with those overall goals. You should develop a cohesive improvement strategy to guide your efforts and ultimately use that strategy to evaluate the success of those efforts. Two actions – making improvement a high personal priority and creating time in your schedule for improvement activities – are vital to this effort and are a clear demonstration to yourself and others of your commitment to improvement.

Step 4: Improve Your Job

Your job may be defined as the collection of the processes you own. You should establish control over your job by defining your processes and understanding how they interrelate and relate to others, including your customers and your suppliers. By removing complexity from your processes and pursuing small, incremental improvements you will substantially increase the effectiveness of your performance in your job, and you will greatly enhance your individual-improvement effort.

Step 5: Improve Yourself

To demonstrate leadership in the improvement effort through your commitment to personal improvement, you must establish and adhere to a structured, disciplined approach to improvement that clearly defines your goals and requires steady, consistent improvement performance. You should also facilitate communication between yourself and others and among others. Remove the barriers you place in your own way, seek the assistance of others to remove the barriers you do not control, and work to eliminate your own fears of change and improvement. Education and communication with others are the best means of removing those barriers and fears. Depend on your vision to guide your improvement and use that vision to maintain your momentum.

Step 6: Help Others Improve

Through your improvement effort, you will help your organization as a whole improve. An essential part of your personal improvement effort should be to help others improve themselves and the organization. By training and coaching others, by creating more leaders, by working to create teams and eliminate barriers, and by encouraging improvement activities of others, you will spread your own example and your enthusiasm throughout the organization. You can personally contribute substantially to the individual-improvement efforts of others.

Step 7: Evaluate Improvement Progress

You must determine how successful you are in your efforts to improve. By measuring your performance against an established base, by recognizing that the value of improvement lies as much in the effort to improve as in the results, and by documenting your improvement efforts so they may be shared with and used by others, you will derive the most from your own efforts. Celebrate your success and the success of others. Use your evaluation to ensure that the improvement effort itself is rewarding and provides strong incentive for continuous improvement effort.

Individual-Improvement Model Summary

The individual-improvement model provides a useful mechanism for pursuing individual change. The individual-improvement model framework presented in Table 5-3 provides a detailed list of the elements found in the presented individual-

improvement model. They are supported by the principles and practices described in Chapters 3 and 4.

TABLE 5-3

INDIVIDUAL-IMPROVEMENT MODEL ELEMENTS

- **Envision personal improvement**
  - Cultivate your self-awareness/image
  - Develop behavior/expectation matrices
    - Assess your relationship with supervisor
    - Assess your relationship with peers
    - Assess your relationship with subordinates
    - Assess relationships with union
    - Assess relationships with customers
  - Evaluate your need/desire to improve
  - Create a personal vision for improvement
- **Enable personal improvement**
  - Improve your education
  - Study concepts
  - Attend conferences
  - Pursue training just in time
  - See your job as learning experience
  - Learn to use the CIP tools
  - Learn to measure and understand processes
  - Learn to use data to support your decisions
  - Learn to differentiate data and information
  - Seek support for your improvement effort
- **Focus on improvement**
  - Examine your mission
  - Establish goals and objectives
  - Communicate your goals
  - Develop a personal-improvement strategy/plan
  - Create job outcome/CIP behavior matrix
  - Describe your behaviors vis-a-vis subordinate
  - Perform a personal signal analysis
  - Make improvement a high priority
  - Make time in your schedule to improve

TABLE 5-3

INDIVIDUAL-IMPROVEMENT MODEL ELEMENTS (Continued)

Focus on improvement (continued)
- Organize your activity to make improvement possible
- Recognize your responsibility to improve
- Take advantage of learning opportunities

Improve your job
- Define your job
- Recognize the processes you own
- Address your job processes
- Understand how your processes link to others
- Understand the capabilities and limitations of your processes
- Know your customers
- Understand their needs and expectations
- Establish routine dialogue with them
- Identify problem areas in your job
- Address critical areas first
- Use a systematic approach to improvement
- Remove complexity and simplify your job
- Pursue small incremental improvements

Improve your behavior
- Constantly challenge your behavior
- Demonstrate leadership
- Demonstrate commitment
- Take initiative
- Take long-term view
- Set an example
- Maintain self-control
- Align your activities with your goals
- Continuously pursue your goals
- Expect improvement in yourself
- Make personal improvement a routine
- Become a good team player
- Foster cooperation
- Foster communication
- Be observant
- Become a good listener

TABLE 5-3

INDIVIDUAL-IMPROVEMENT MODEL ELEMENTS (Continued)

Improve your behavior (continued)
- Open up your communication channels
- Remove the barriers you erect
- Work to eliminate your fears
- Don't be unduly critical of yourself
- Pursue innovative thinking and new ideas
- Eliminate roadblocks
- Trust and deserve trust

Help others improve
- Make time in your schedule to help others improve
- Involve others in decision processes
- Train others
- Coach and nurture
- Create more leaders
- Facilitate teamwork
- Help remove others' barriers
- Learn what questions to ask and how to ask them
- Encourage small improvements by others
- Encourage innovative thinking in others
- Support implementation of subordinate's ideas
- Welcome the news of problems as opportunities
- Expect improvement in others
- Help remove the sources of others' fears
- Welcome the new ideas of others

Evaluate your improvement
- Recognize the value of correct effort versus results
- Judge others fairly and correctly
- Don't be unduly critical of others
- Document improvement in an improvement journal
- Celebrate your successes
- Celebrate the successes of others

Personal change is of course a very personal journey. To the extent that this model is helpful, use it and recommend it to others. Every organizational transformation begins with an individual recognition of the need for change and a personal initiative to lead the effort. There resides within each individual the seeds of leadership. Let yours grow and flourish.

Good luck and joy on your journey!

APPENDIX A

CONTINUOUS IMPROVEMENT PROCESS MATURITY CHECKLIST

VISION

- Does the organization have consensus on a shared vision?
- Does the organization have a vision that is realistic and possible?
- Does the organization have a vision that is rooted in understanding of customer/market?
- Does the organization have a vision statement that is clearly written and disseminated to all employees, customers, and vendors?
- Can employees understand and cite the vision statement?
- Do employees feel a stake in achieving the vision?
- Can employees state how they can contribute to realizing the vision?

PRINCIPLES

Constancy of Purpose

- Does the organization have a written statement of vision for the organization?
- Does the organization have a set of long-, medium-, and short-range goals and objectives clearly linked to the purpose and vision?
- Does the organization have a set of strategic and tactical plans that provide the road maps for reaching the goals and objectives?
- Does the organization have a consistent awareness among all organization members of the vision, goals, objectives, and plans and of their personal roles in achieving them?
- Does the organization have a shared belief among organization members that management's behavior clearly signals its commitment to, and support of, the vision?

- Has top management mandated, through policy, that the Continuous Improvement Process (CIP) be deployed into the organization through a top-down methodology?
- Has top management required that successive layers of interlocking process-improvement teams be created, starting with a top-level Executive Steering Committee, to direct the flow CIP into the organization?
- Has top management implemented the practices that support top-down implementation?
- Has top management created a performance measure that tracks the deployment of CIP into the organization?
- Has each manager/employee been trained in CIP and has each used the process in his/her own activities prior to requiring any subordinates to employ the process?
- Does the organization have a plan to proceed as quickly and effectively as possible to educate and involve the top critical mass of management in CIP?
- Does the organization have a means to assure that the critical mass remains in place and actively engaged in CIP in spite of personnel turnovers, crisis diversions, or the onset of complacency after the critical period is considered to be over?

Commitment to Quality

- Does the organization have a clear statement and ongoing visible actions from top management that reflect its commitment to quality through fostering change for continuous improvement?
- Does the organization have a strategy for identifying customer needs and expectations and for translating them into guidance to focus decisions and change action?
- Does the organization have a means to disseminate within the organization the attitudes and behavior that are consistent with a commitment to quality?
- Does the organization have a dynamic and structured process for examining and improving all major processes?
- Has top management stated, through policy, that its highest commitment is to facilitating continuous improvement in all the organization's processes?
- Has top management mandated that commitment be demonstrated through management actions that materially contribute to CIP?

- Has top management created a performance measurement system that includes a performance measure for action-based demonstration of management commitment?
- Can each manager/employee cite specific examples of action-based commitment by higher level management that has contributed to tangible improvement?

Customer Focus

- Has the organization clearly identified its external customers?
- Does the organization have a current and accurate means for assessing the customers' needs and expectations with respect to the offered products or services?
- Does the organization have a set of performance measures that indicates external customers' response with respect to the products and services?
- Does the organization have a means for identifying internal customers?
- Does the organization have a means by which internal customers define their needs and expectations with respect to products and services they receive?
- Does the organization have a set of performance measures linked to the internal products and services to indicate the degree to which customer requirements are satisfied?
- Does the organization have a means for integrating and ensuring the alignment of the internal requirements and measures with those of the external customers?
- Has top management mandated, through policy, that continuous improvement in processes be based on increasing internal and external customer satisfaction?
- Does top management require that process documentation explicitly identify the customer requirements (needs and expectations) with respect to the delivered product or service?
- Has top management implemented the practices that support customer focus?
- Has top management required that specific process-related measurements be employed in each process that assess performance with respect to customer requirements?

- Is each manager/employee aware of his customers and able to cite the customers' requirements with respect to the work accomplished in his/her process?

Process Orientation

- Has the organization trained all personnel in process analysis?
- Are all personnel familiar with the processes in which they work and for which they are responsible?
- Has the organization documented all processes by process flow diagrams and written descriptions?
- Has the organization identified customers for each stage of a process and defined their needs and expectations for the products or services they receive?
- Has the organization defined for each process stage performance measures that indicate whether the stage is operating correctly?
- Does the organization have a means for using product and process measurement data systematically to control and improve process performance?
- Has top management required, through policy, that all processes be defined and documented as part of CIP?
- Has top management defined the processes it owns, and do those processes encompass all other functions and activities?
- Has top management implemented the practices that support process orientation?
- Has top management mandated the measurement of continuous improvement based on process-performance indicators?
- Does each manager/employee understand and can he/she describe the process he/she owns?

Continuous Improvement

- Does the organization have an improvement strategy that integrates and stimulates incremental changes with the innovation process?
- Is the organization sensitive to and eager to listen to even the smallest ideas or suggestions for improvement?

- Does the organization have a training program to educate all employees in the principles, techniques, and tools that support the incremental improvement process?
- Does the organization have a means to quickly and easily facilitate the continuous stream of many small improvements?
- Do managers clearly cite continuous improvement as a high-priority objective?
- Has top management promulgated continuous improvement goals that affect every function and activity?
- Is the foremost measurement of performance linked to continuous improvement?

System-Centered Management

- Does the organization have a clear policy statement that managers own their processes and have a responsibility for assuring the continuous improvement of those processes in line with the realization of organizational goals?
- Does the organization have a functioning network of management teams that meet regularly to deal with system-level improvement issues?
- Does the organization have an explicit component of the management reward and recognition system that addresses and stimulates system-level improvements?
- Does management continuously signal that eliminating the potential for fires from the system is in the long run more important than fighting fires?

Investment in Knowledge

- Does the organization have a vigorous training program with the appropriate staff and training materials and support?
- Does the organization have a means of measuring training effectiveness in terms of increased job performance?
- Does the organization have a just-in-time policy and plan for training that enables continuous improvement in the skills and knowledge inventory of every employee?
- Does the organization have a reward and recognition system that encourages and acknowledges the intellectual contributions and achievements of all employees?

Teamwork

- Does the organization have a policy governing the creation and operation of process-improvement teams, including all personnel and all processes?
- Does the organization have a top-down structure of interrelated process-improvement teams, including cross-functional and special teams?
- Does the organization have a mechanism to assure that all the teams engage in process-improvement activity appropriate to their level on an ongoing basis?
- Does the organization have a reward and recognition system that reflects team performance?

Conservation of Human Resources

- Does the organization have a clear, visible, and enforced policy that people are the organization's most important resource and that as such they will be treated with respect and helped to grow in a challenging and secure environment?
- Does the organization have a process for educating employees about team dynamics and appropriate and expected interpersonal behavior?
- Does the organization have a means of monitoring and measuring the quality-of-work-life factors and for providing for feedback and improvement?
- Does the organization have a bias toward investing in people, providing training, creating opportunity, unlocking talent, driving out fear, breaking down barriers, opening communication channels, and listening?
- Does the organization have a policy that personnel reductions will be the last avenue of recourse when seeking cost reductions?

Total Involvement

- Does the organization have a clear policy statement that makes total involvement an organizational goal?
- Does the organization have a strategy for the orderly deployment of a CIP culture into the organization in a way that achieves the "waterfall effect" of training and team activity involving everyone?
- Does the organization have an explicit expectation communicated through the signals from top management that participation in the improvement

process is part of everyone's job and is demonstrated through both team and individual behavior?

- Does the organization have a structure of process-improvement teams that are linked and interact to reinforce and sustain improvement activity?
- Does the organization have a disciplined approach to improvement that includes goals, projects, and the repetitive application of rigorous and defined techniques?
- Does the organization have a plan for engaging organized labor and suppliers in the improvement process and in team activity?
- Has top management mandated, through policy, that every manager and employee will be trained in and will practice continuous improvement?
- Does top management require that each individual become involved in the process through team participation and activity that is centered around the process in which the individual shares ownership?
- Does top management actively enable the practices that support total involvement?
- Does the organization's top management have performance measures that indicates the progress toward total involvement?
- Does the organization's top management ensure that each employee recognizes his role in the scheme of continuous improvement and can cite how his/her involvement, through team activity, relates to achieving goals and objectives?

Perpetual Commitment

- Has the organization clearly documented its perpetual commitment to the improvement process and is that commitment visible throughout the organization?
- Does the organization have improvement-promoting signals clearly manifested in everything that management does: in meetings, speeches, communications, public relations, decisions, reward and recognition systems, and interpersonal relationships?
- Does the organization have a process by which all new employees are educated in improvement process fundamentals as part of their standard orientation?
- Does the organization have a strategy for ensuring that the improvement process is as immune as possible from the changing parade of personalities

and from short-term crises that will continuously stir the management ranks?

POLICY

- Has top management produced a clear and complete body of policy that addresses each principle?
- Does the organization's top management promulgate policy throughout the organization such that all employees have access to and are aware of the principle-based policies?
- Does the organization's top management verify the effectiveness and compliance with written policy?
- Does the organization's top management regularly review policy and revise and improve policy statements as necessary?

STRATEGIC PLAN

- Does the organization's top management have a strategic plan that describes long-, medium-, and short-range goals and objectives?

PRACTICES

Support of Constancy of Purpose

Planning

- Does the organization have a documented planning policy?
- Does the organization provide training in planning requirements, techniques, and tools?
- Does the organization emphasize that good planning lies at the core of doing anything right the first time?
- Does the organization make sure that all levels of management understand that anything worth doing right the first time is worth taking the time to plan?
- Does the organization provide mechanisms to prevent major improvement activities from entering the "doing" phase without an adequate plan?
- Does the organization take the mystery out of planning so that everyone learns how to plan and is expected to participate in team planning activities?

Goal Setting

- Does the organization address the role and importance of goal setting as part of planning policy?
- Does the organization provide instruction in goal setting techniques and responsibilities for all managers and improvement teams?
- Does the organization only set goals that have a clear linkage to the means and methods for their achievement?
- Does the organization make sure that those who establish the goals have the primary responsibility for achieving them?
- Does the organization develop goals from a clear understanding of the needs and expectations of customers?
- Does the organization create meaningful indicators of performance that are unambiguous control and check points on the path for achieving the goals?

Policy Deployment

- Has the organization documented the policy deployment process as part of organizational planning policy?
- Does the organization address policy deployment in improvement process training that is provided to everyone?
- Has the organization deployed a documented improvement policy, goals, and objectives into the organization?
- Does the organization ensure that processes and projects have improvement-action plans and performance measurements that are relevant to the achievement of top-level goals?
- Does the organization promote individual awareness of improvement policy, goals, and objectives and facilitate an appreciation of their relationship to the individual's job?

Implementing Economically

- Has the organization developed and documented a policy of simplifying and improving existing processes using the resources already available before attempting any major high-cost/high-technology solutions?
- Does the organization provide training on the techniques and tools for process simplification and improvement and on the importance and implications of economic implementation?

- Does the organization evaluate proposals for high-cost solutions based on hard evidence that the target processes have been improved to their full potential and that economic solutions have been fully exploited?
- Does the organization ensure that process- and project-improvement action planning addresses a full range of economic implementation options?
- Does the organization promote awareness of the individual's role in suggesting economic improvement ideas by responding rapidly and affirmatively to suggestions for simple low-cost improvements?

Allocating Resources Efficiently

- Has the organization documented a policy on the efficient allocation of resources that provides strong incentives to employ low-resource solutions first, reinvest savings in additional improvement, and reduce the size of "empires"?
- Does the organization train the work force in the efficient use of resources and make available the techniques and tools to facilitate the rapid application of new knowledge?
- Does the organization provide positive incentives so that managers use resources efficiently and reduce their budget and personnel requirements?
- Does the organization publicize success stories and reward managers who demonstrate how to accomplish more with less?
- Does the organization ensure that the actions taken to efficiently employ resources do not become threats to the work force?

Long-Term Contracting

- Has the organization developed a means for evaluating and selecting the best vendors for long-term contracts based on price, demonstrated performance, and demonstrated capability to generate continuous improvement?
- Does the organization foster teamwork, trust, and fairness in all transactions with preferred suppliers?
- Does the organization build a close working relationship with preferred suppliers to support the mutual development of CIP practices?
- Does the organization establish goals for accepting no defective products and attaining levels of supplier process control that preclude the need for incoming inspection?

- Does the organization seek to develop suppliers capable of fully supporting just-in-time delivery and production?

Support of Commitment to Quality

Deploying Quality

- Has the organization developed a clear quality-deployment policy, especially for new product development and business planning?
- Does the organization provide training in quality function deployment and ensure that all personnel understand and effectively employ the techniques and tools?
- Does the organization require its managers to become actively involved in the quality-deployment process, facilitate cross-functional communication, and vigorously work to remove roadblocks and resolve problems quickly?
- Does the organization make deploying quality into its products, services, and processes a high priority?

Robust Design Development

- Has the organization developed a clear policy of designing robust products and making production of robust products, services, and processes a high priority?
- Does the organization stress early application of advanced engineering techniques and tools in new product development and business planning?
- Does the organization provide training in advanced design development techniques?
- Does the organization ensure that all personnel understand and effectively employ the techniques and tools that produce robust designs?
- Does the organization require managers to become actively involved in the design development process, employ statistical methods, facilitate design experiments, and vigorously work to remove design process roadblocks?

Improving Production Flow and Reducing Inventory

- Has the organization developed a clear policy dealing with production flow and inventory management?
- Does the organization provide training in production flow improvement and inventory reduction techniques?

- Does the organization ensure that management signals and actions are consistent with maintaining balanced process flows and optimum inventory levels?
- Does the organization recognize the synergy of the various process-flow and inventory-management techniques and has it devised a comprehensive strategy for their implementation and integration?
- Does the organization involve suppliers in the plan to improve process flows and reduce inventories?
- Has the organization established meaningful measurement systems to accurately reflect process flow and inventory performance and improvement?
- Does the organization provide healthy communication, feedback, reward, and recognition to stimulate individual and team initiatives for process-flow and inventory-management improvement?

Support of Customer Focus

Researching External Customers

- Does the organization make customer focus a cornerstone of its business and improvement strategies?
- Does the organization emphasize through training the importance of understanding and responding to customer needs?
- Does the organization expand market research to include engineering, manufacturing, service, and other appropriate personnel and information?
- Does the organization develop employee exchange programs with major customers where feasible?
- Does the organization create responsive channels for customer communication and feedback?

Addressing Internal Customers

- Does the organization have a policy that requires each individual and process team to know its customers and converse with them regularly?
- Does the organization address the importance of communication and stress communications skills through training and facilitation?
- Has the organization established a regular and formal process for obtaining information about customer satisfaction?

- Does the organization ensure that both suppliers and customers understand the purpose of formal information gathering, such as surveys, and ensure that the results are shared with the work force?
- Does the organization have a measurement system that relates customer satisfaction to process performance?
- Does the organization ensure that the requirements and measurements of internal customer satisfaction are compatible with external customer needs?

Support of Process Orientation

Simplifying Processes

- Does the organization make process simplification part of its improvement policy and require a process simplification analysis before approving major financial investments in new process technology?
- Does the organization provide training in the techniques and tools of process simplification?
- Does the organization make process simplification a primary responsibility of the improvement teams?
- Does the organization facilitate and assist the teams in performing and executing process simplification?
- Is the organization willing to give up many non-value-added activities even though they have become part of management's "sense of control"?

Defining Standards

- Has the organization documented a policy that requires all processes to be described and standardized?
- Does the organization provide training on the techniques and tools for process standardization?
- Does the organization ensure that planning addresses all three phases of the standardization process?
- Does the organization have a capability to capture and maintain process standards and to employ them for performance validation?
- Does the organization make defining process standards a high and early priority in its improvement effort?

- Does the organization develop training and guidance on the proper development and use of process standards?
- Does the organization expect the process standard development to start as part of process-improvement team training activity?
- Does the organization provide facilitation and support to the process-improvement teams to ensure that the process standards are efficiently and consistently produced?

Maintaining Standards

- Has the organization developed a policy that makes the improvement team that owns the process responsible for maintaining the process standards?
- Does the organization provide the training and necessary resources to support standards maintenance?
- Does the organization perform periodic audits to validate job performance against the process or job standards?
- Does the organization ensure that the work is done in accordance with the work standards and, if it is, does the organization avoid blaming the work force for defects or problems?
- Does the organization recognize defects and problems as signals that the process standards must be improved?

Improving Standards

- Does the organization expect process standards to be routinely upgraded as part of the overall process-improvement effort and question the long-term lack of change to any process standard?
- Does the organization provide training on the methods and requirements for standards improvement, including the *Standardize-Do-Check-Act* cycle?
- Does the organization recognize and communicate that standards improvement is a process-improvement team responsibility?
- Does the organization encourage the pursuit of improvements on a large scale and a small scale and reward and recognize originators of improvements accordingly?
- Does the organization ensure that standards improvement is a positive, simple, and nonthreatening process for the worker?

Improving Processes

- Does the organization demonstrate an unambiguous commitment from top management to understand and improve all its processes?
- Does the organization provide clear objectives and guidance for process improvement through its strategic planning?
- Has the organization developed a network of process-improvement teams that take ownership of their processes and work systematically for their improvement using simplification, standardization, and improvement methods such as *Plan-Do-Check-Act* techniques?
- Does the organization ensure that every individual is encouraged and has the opportunity to participate in process-improvement activity?
- Does the organization expect every process-improvement team to be working on at least one process-improvement project at any given time?
- Does the organization provide timely reward and recognition for process-improvement effort and results?

Support of Continuous Improvement

Promoting Small Improvements

- Does the organization have a clear policy on pursuing small-step process improvements to optimize the use of existing technologies and systems before approving major investments in new technologies?
- Does the organization train teams and individuals, including managers, on the methods, themes, and importance of small improvement initiatives?
- Does the organization develop a simple and responsive suggestion system to capture, recognize, and reward small improvement ideas?
- Does the organization foster team and individual ownership of job processes by moving responsibility, authority, and control over improvement to the lowest level possible?
- Has the organization developed a disciplined methodology for managing change and a measurement system at the process level to track performance and to ensure that the change process yields human knowledge as well as physical process improvement?

Research and Development – Innovation

- Has the organization developed an R&D policy that is appropriate for the nature of the business and that will provide sufficient resources to develop the innovations required for timely and sustained improvement?
- Does the organization train R&D personnel in the appropriate CIP practices, techniques, and tools and encourage their application to both applied and pure research efforts?
- Does the organization establish goals and objectives for R&D that are consistent with the organization's constancy of purpose and commitment to quality?
- Does the organization ensure that the R&D effort and the small-step component of the improvement process are deliberately integrated?

Performance Measurement

- Does the organization increasingly base its decisions and actions on statistical evidence and rely less on intuitive approaches?
- Has the organization developed a performance measurement policy that makes the teams or individuals who own the process responsible for process measurement systems?
- Does the organization provide some level of training in measurement and statistical methods to all personnel?
- Does the organization use performance measurement data to identify improvement needs and to target assistance, not to fix blame?
- Does the organization provide professional performance measurement assistance in the form of a statistician or other qualified person?
- Does the organization ensure integrity in the measurement system by promoting pride in process ownership, sending trusting and supporting signals, and appropriately auditing the process?
- Does the organization increase vertical and horizontal communication and assist the coalition of a process-team network by requiring the exchange of mutually interesting measurement data?
- Does the organization maintain performance information in accordance with the needs of the organization and the requirements of the customers?

Improving Through Projects

- Does the organization follow a policy of structuring project teams with qualified people representing the perspectives of all the suppliers and customers affected by the improvement project?
- Does the organization train project team members in all the relevant CIP disciplines?
- Does the organization ensure that projects are properly planned and executed, have specific goals and objectives and defined time requirements, and have sufficient management guidance and support to deal with potential roadblocks?
- Does the organization require process-improvement teams to routinely engage in a process-related improvement project and, in general, conform to the discipline of the PDCA learning cycle?

Communicating with Data

- Has the organization established a clear policy of basing management decisions and actions on the evidence of data rather than on opinion?
- Does the organization train all personnel on the proper collection, analysis, and use of performance data?
- Does the organization provide the necessary resources, tools, and technical support to ensure that data are appropriately, efficiently, and effectively used?
- Does the organization emphasize the importance of relying on data by calling for the use of data in discussions and meetings and by posting important data prominently and in a timely manner?
- Does the organization send clear signals that good data are essential and valuable by limiting the requirements for data to those that are useful and used?

Variability Reduction

- Has the organization developed a clear policy promoting variability reduction for all its processes?
- Does the organization train all its people, especially its managers, in the techniques and tools for variability reduction?
- Has the organization developed a performance measurement system that will permit variance in all key processes to be monitored and controlled?

- Has the organization established the means to define the "voice of the customer" and to determine, quantify, and improve process capability?

Reducing the Vendor Base

- Has the organization developed a strategy for reducing the number of suppliers to a minimum but sufficient quantity?
- Has the organization developed a method for rating and selecting preferred suppliers?
- Has the organization established a vendor-development process to promote and support the development of CIP practices in vendor operations?
- Does the organization involve the preferred suppliers in the internal CIP problem-solving activities in which their products or services play a part?

Preventing Defects

- Has the organization developed a clear definition and understanding of what defect prevention really means and how it relates to top management, long-term business strategy, and survival of the organization?
- Has the organization developed a long view of how defect prevention should unfold in the organization and a strategy for facilitating the process?
- Does the organization demonstrate a commitment to defect prevention starting from the top, by recognizing and addressing the management system contribution to the production of defects?
- Has the organization created a defect-detection and tracking system and a process for continuously reducing the number of defects?
- Does the organization insist that identified defects be traced to their root causes and corrective actions be addressed to root causes rather than to symptoms?

Managing Upstream Processes

- Has the organization developed a clear policy with respect to upstream management, establishment of cross-functional communications, and integration of downstream considerations in upstream decision making?
- Does the organization provide training in the principles, practices, techniques, and tools that are essential for effective upstream management?

- Can the organization track the performance of the upstream management processes as well as provide feedback on the effectiveness of upstream decisions and actions in reducing downstream issues?

Support of System-Centered Management

Developing Responsibility and Authority

- Has the organization developed a clear statement of every manager's responsibility and authority for implementing and employing CIP?
- Has the organization examined the alignment of responsibility and accountability throughout the organization and does it continuously foster improvements in it?
- Has the organization created a training program that addresses responsibility and authority, their relationship to improvement, and their proper assignment with respect to processes and jobs?
- Does the organization use process-control and measurement systems that enable individuals to influence performance and results commensurate with their accountability?
- Has the organization provided a communication and feedback mechanism sensitive to the concerns of middle managers and the needs of subordinates as responsibility and accountability are deployed lower into the organization?
- Has the organization devised a reward and recognition system that clearly conveys the accountability of every manager to demonstrate CIP-compatible behavior and to continuously improve processes, products, and services?
- Has the organization developed a mechanism for identifying and removing any roadblocks that could prevent a manager from recognizing or exercising his CIP responsibility and authority?

Removing Sociocultural Barriers

- Has the organization developed a policy of systematically identifying and eliminating sociocultural barriers?
- Does the organization train managers and supervisors in sociocultural barrier recognition and removal?
- Has the organization established a mechanism for open communication and feedback about sociocultural issues?

- Has the organization developed a reward and recognition system that promotes and is sensitive to healthy sociocultural behaviors and relationships?
- Does the organization consider "management-by-walking-around" an essential part of management behavior?
- Has the organization ensured that top-level managers are present at CIP activities, team kick-offs, milestones, and success celebrations?
- Does the organization recognize the value of managers walking around even if it takes time away from work on the traditional in-box and firefighting issues?

Removing Roadblocks and Bottlenecks

- Has the organization prepared and disseminated guidelines for systematically identifying and eliminating roadblocks and bottlenecks?
- Does the organization provide training for managers and supervisors in roadblock and bottleneck recognition and removal?
- Has the organization established a mechanism for open communication and feedback about roadblocks and bottlenecks?
- Has the organization developed a reward and recognition system that promotes roadblock and bottleneck removal?
- Does the organization consider roadblock and bottleneck removal an essential part of good management behavior?

Support of Investment in Knowledge

Training

- Has the organization documented a policy that recognizes training as an important and permanent part of CIP and stresses the just-in-time delivery of training?
- Does the organization provide early emphasis on developing a training strategy and sufficient up-front attention and resources to create a tailored training program?
- Does the organization practice a cascade approach to training that involves supervisors directly in delivering on-the-job training to subordinates?
- Does the organization employ group training that combines the delivery of new information with the immediate application of that information to group improvement activity?

Facilitation

- Does the organization have a well-trained and highly professional internal facilitation staff?
- Has the organization established the facilitation staff as an independent staff function reporting to the highest level of management?
- Does the organization provide a strong and visible mandate for the facilitation staff and make available sufficient resources and backing, as appropriate, to overcome roadblocks and resistance?

Enhancing Communication

- Has the organization developed a communication policy that encourages an energetic and open flow of information both vertically and horizontally?
- Has the organization promulgated a comprehensive communication-improvement strategy that addresses both the internal and the external environments?
- Does the organization employ a cross-functional improvement team to examine and improve the communication processes?
- Has the organization become aware of formal and informal communication mechanisms and does it seek to align and employ both for advancing improvement?
- Does the organization address the covert forms of communication through signal analysis and education to ensure that the subtle signals are compatible with the official pronouncements about improvement?

Using External Experts

- Does the organization carefully investigate the ideas and methods of a number of different consultants to determine which ones best fit the needs of the organization?
- Does the organization have a plan that will move the organization toward a self-sustaining CIP operation?
- Does the organization build on the experience of other pioneer organizations and use proven techniques and tools rather than reinventing the wheel because "we are different"?

Assessing External Factors

- Does the organization recognize that survival depends on understanding the nature of the marketplace, identifying opportunities and risks, and planning for success?
- Has the organization developed a means to collect and analyze information on those external factors that influence its competitiveness and survival?
- Does the organization involve top management in translating the findings of external assessments into business opportunities and strategic directions?
- Does the organization share management's understanding and relevant marketplace information with the organization's entire work force?

Assessing Internal Factors

- Does the organization recognize that success and survival depend as much on understanding the internal issues and pursuing the opportunities for improvement as they do on external market factors?
- Does the organization conduct an internal assessment as part of the annual planning process to give the functional areas and teams a forum for input to the review process?
- Has the organization developed a structured means to collect and analyze internal infrastructure information and translate those data into improvement actions?
- Does the organization share the internal assessment information with the employees and involve them in the improvement process?

Support of Teamwork

Team Building

- Has the organization documented a policy on the creation of permanent process-improvement teams that have true process ownership?
- Does the organization provide team training specifically oriented toward building teamwork and team cohesiveness?
- Does the organization orient reward and recognition to reinforce positive team behavior?

- Does the organization ensure that teams are not created in isolation but with viable management support structures to provide essential guidance, oversight, and facilitation?
- Does the organization seek to create teams to work on improvement for all processes and to involve everyone in process-improvement team activity?

Seeding Improvement Teams

- Has the organization documented a policy that team seeding is an interim approach to obtain rapid action in chronic problem areas?
- Does the organization provide training in CIP principles, practices, and techniques to the complete management chain that owns the target process or ensure direct access to top management through special reporting relationships?
- Does the organization give high visibility to seeded teams and clear, fast, and certain reward and recognition for desired behavior and achievements?
- Does the organization make an extra effort to ensure the success of seeded teams since they will have high visibility and be precedent-setting in their functional area?
- Does the organization try to target areas for team seeding and improvement action that have high probability of success as well as significant payback potential?

Integrating Functions and Cross-Functional Integration

- With respect to cross-functional integration, has the organization documented a policy that addresses cross-functional teaming, collocation, and cross training?
- Does the organization encourage and provide support for cross training and cross-functional exchanges of personnel?
- Does the organization recognize and reward the acquisition of new skills and make new learning opportunities readily available to all employees?
- Does the organization facilitate the broad application of skills by designing a work environment in which generalists rather than specialists are developed?

Support of Conservation of Human Resources

Rewarding and Recognizing

- Has the organization established clear guidelines on desired behavior and its reinforcement through reward and recognition?
- Does the organization train managers in creative employment of the reward and recognition system?
- Does the organization cite managers for their behavior in appropriately rewarding and recognizing their people?
- Does the organization employ frequent and flexible nonmonetary reward for a broad array of desirable behavior?
- Has the organization devised a reward and recognition plan that is understood by all levels in the organization?
- Does the organization use negative means, such as punishment, only in extreme circumstances and only with certain knowledge of their appropriate application?
- Does the organization make optimum use of communication media to obtain broad awareness of reward and recognition actions?
- Does the organization assure that top management is actively engaged and clearly visible to the work force in the reward and recognition process?

Celebration

- Has the organization established clear guidelines about celebration and ensured that management training addresses the issue of celebrating success?
- Does the organization make celebration a frequent, meaningful, and personal event for individuals, teams, and families?
- Does the organization ensure that top management participates routinely and actively in the celebration process?
- Does the organization employ nonmonetary means to celebrate success in preference to motivating with money?
- Does the organization include customers and suppliers in an appropriate way in celebrations?
- Does the organization link celebrations in a timely way to the specific events or behaviors being celebrated?

- Does the organization make celebrations diverse and varied expressions of appreciation that recognize small accomplishments as well as large ones?

Gain Sharing

- Has the organization developed a clear policy about gain sharing and provided management guidelines for its fair administration?
- Does the organization provide management and employee training in the gain-sharing process?
- Has the organization developed a plan that ensures equal opportunity for all employees to benefit from the gain-sharing process?
- Has the organization ensured that the gain-sharing formula is based on factors that are largely under the control of the employees?
- Has the organization made certain that the gain-sharing plan is suitable for the long-term goals of the company and not merely designed for the immediate situation?
- Does the organization ensure that managers facilitate employee participation and access to gain sharing and become partners in the process rather than adversaries?

Support of Total Involvement

Involving Employees

- Has the organization established clear guidelines on manager and employee involvement in improvement activity?
- Does the organization provide management training in interpersonal and leadership skills?
- Does the organization recognize that real involvement in improvement activity is a personal decision, involving some ego risk and that willingness to take such risk is significantly tied to the organizational environment?
- Has the organization developed an environment in which the individual is respected and the managers listen to them and help them grow?
- Has the organization created an atmosphere in which taking risks is encouraged, failure is acceptable, and innovation is valued?
- Has the organization built a strong management ethic under which managers set the example and actively lead the improvement effort?

- Has the organization developed improvement process-sustaining mechanisms to assure that improvement efforts, once started, are not neglected nor allowed to wither?
- Does the organization make it clear that people are automatically members of process-improvement teams by virtue of their jobs being part of the process but that active involvement in improvement activity remains a desirable, encouraged, but personal prerogative?

Generating Ideas – Suggestion Systems

- Has the organization developed clear guidelines for establishing and operating an idea-generating process, including a viable suggestion system?
- Does the organization provide management training in receiving, evaluating, developing, and implementing employee suggestions?
- Has the organization established a flexible and appropriate mechanism for recognizing and rewarding individual and team contributions to the pool of ideas and suggestions?
- Has the organization developed a mechanism to capture and retain a history of implemented suggestions and to use that history to continuously improve the idea-generating process?
- Does the organization expect and reward management behavior that supports and promotes the generation of new ideas, creativity, and improvement?
- Does the organization implement small ideas for improvement as readily as large ones?
- Does the organization promote the generation of a large volume of smaller improvement ideas over a small number of large payback ideas?
- Does the organization encourage individuals and teams to generate ideas they may implement to improve their own jobs and processes?

Involving Customers

- Has the organization developed clear guidelines on customer awareness and involving customers in the improvement process?
- Does the organization provide training in customer relations to help employees recognize, communicate, and develop positive relationships with their customers?

- Has the organization established mechanisms to solicit customer ideas, suggestions, and concerns and employ that information in improvement decision making?
- Does the organization provide, as appropriate, customer training that is useful, clear, and simple and that meets customer needs?
- Does the organization involve customers in problem-solving activities particularly when the problems under consideration directly relate to customer satisfaction?
- Does the organization include customers, particularly directly affected internal customers, in process-improvement team activity?
- Does the organization involve customers in equipment service and maintenance activity, as appropriate, but ensure that customer tasks are simple, clean, and safe?
- Does the organization provide customer recognition, especially in appreciation of customer contributions to the improvement process?
- Has the organization established mechanisms to involve customers in performance measurement and to tie system performance to customer satisfaction?

Involving the Union

- Has the organization established clear guidelines regarding union involvement and will those guidelines encourage union-management cooperation in creating a culture for improvement?
- Does the organization promote direct participation by union leadership in improvement-process activities from the earliest possible moment?
- Does the organization provide a means by which the unions can submit ideas and suggestions to the improvement process?
- Does the organization ensure that union contributions to continuous improvement are appropriately recognized?
- Does the organization involve union leadership in CIP management training?
- Does the organization include union leadership in problem-solving activity and on top-level process-improvement teams?
- Does the organization recognize that the union is in fact a customer for some of the organization's processes?

- Does the organization ensure that union involvement extends to performance measurement activity, particularly where the union meets the criteria of the customer?

Involving Suppliers

- Has the organization established a goal of ultimately buying only from vendors that are committed to continuous improvement and quality?
- Has the organization developed a plan for actively engaging the vendor base in CIP, including planning, training, problem solving, and information exchange?
- Has the organization designed a method for rating and tracking vendor performance against CIP criteria?
- Has the organization published clear guidelines about involving vendors in the improvement process?
- Does the organization provide training in vendor relations to help employees recognize, communicate, and develop positive relationships with their vendors?
- Has the organization established mechanisms to solicit vendor ideas, suggestions, and concerns and to employ that information in improvement decision making?
- Does the organization provide appropriate vendor training that is useful, clear, and simple and that meets vendors' needs?
- Does the organization involve vendors in problem-solving activities, particularly when problems under consideration directly relate to customer satisfaction?
- Does the organization include vendors as appropriate in process-improvement-team activities?
- Does the organization provide vendor recognition, especially in appreciation of their contributions to the improvement process?
- Has the organization established mechanisms to involve vendors in performance measurement and tie their performance to ultimate customer satisfaction?

APPENDIX B

SUGGESTED READING AND REFERENCES

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